

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:54

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-08	Plot Reference	001
Address	Plot 8 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.46 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.9 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.37 kWh _{PE} /m ²		
Dwelling primary energy	46.98 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.6 kWh/m ²		
Dwelling fabric energy efficiency	33.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	109.68	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	West	1.0	1.2
Rear, Window	9.63	East	1.0	1.2
Front, Door	2.15	West	N/A	1.2
Side, Window	4.95	South	1.0	1.2
Velux, Rooflights	1.14	East	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

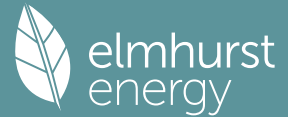
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Full SAP Calculation Printout



Property Reference	77942-01			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 1, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.13	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

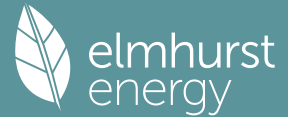
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199 (29a)
PIU	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0831		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$

(28)...(30) + (32) + (32a)...(32e) = 12798.1999 (34)
96.0826 (35)

List of Thermal Bridges

K1 Element
E2 Other lintels (including other steel lintels)
E3 Sill
E4 Jamb
E5 Ground floor (normal)
E16 Corner (normal)
E18 Party wall between dwellings
P1 Party wall - Ground floor
P4 Party wall - Roof (insulation at ceiling level)
E6 Intermediate floor within a dwelling
E11 Eaves (insulation at rafter level)
E13 Gable (insulation at rafter level)
R5 Ridge (inverted)
P5 Party wall - Roof (insulation at rafter level)
R4 Ridge (vaulted ceiling)
E17 Corner (inverted - internal area greater than external area)
R1 Head of roof window
R2 Sill of roof window
R3 Jamb of roof window

Length	Psi-value	Total
17.9200	0.0500	0.8960
17.9200	0.0500	0.8960
37.1500	0.0500	1.8575
21.5800	0.1600	3.4528
21.1700	0.0900	1.9053
14.1100	0.0600	0.8466
8.7000	0.0800	0.6960
4.6500	0.0600	0.2790
21.5800	0.0000	0.0000
13.5900	0.0400	0.5436
11.5900	0.0800	0.9272
5.7100	0.0400	0.2284
5.8700	0.0800	0.4696
13.1800	0.0800	1.0544
7.0600	-0.0900	-0.6354
1.1800	0.0800	0.0944
1.1800	0.0800	0.0944
1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

(36a) = 0.0000
(33) + (36) + (36a) = 73.8433 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(39)
Average = Sum(39)m / 12 =	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

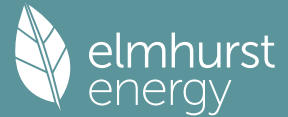
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	633.2020	650.3745	620.5097	597.4465	564.0111	538.9493	515.9071	516.5077	533.9762	556.7121	594.1231	618.4277	(73)

6. Solar gains

Full SAP Calculation Printout



[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
East		7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (76)
South		4.9500	46.7521	0.3300	0.0000	0.7700	58.8045 (78)
West		9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (80)
West		1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847 (83)
Total gains	787.3807	933.7755	1052.6393	1189.5662	1266.1838	1249.7601	1195.7485	1114.4077	1022.7274	882.9386	782.8398	747.6124 (84)

7. Mean internal temperature (heating season)

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

21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125
alpha	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875
util living area	0.9622	0.9391	0.9016	0.8255	0.7120	0.5648	0.4339	0.4777	0.6784	0.8662	0.9430	0.9671 (86)
MIT	18.7334	19.0628	19.5249	20.0906	20.5494	20.8346	20.9431	20.9235	20.7079	20.0842	19.2956	18.6536 (87)
Th 2	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314 (88)
util rest of house	0.9572	0.9312	0.8886	0.8022	0.6731	0.5053	0.3572	0.3998	0.6234	0.8429	0.9342	0.9627 (89)
MIT 2	17.4511	17.8663	18.4456	19.1411	19.6831	19.9946	20.0961	20.0813	19.8712	19.1485	18.1661	17.3501 (90)
Living area fraction	17.5703	17.9775	18.5459	19.2293	19.7636	20.0726	20.1748	20.1596	19.9490	19.2354	18.2711	17.4712 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4203	17.8275	18.3959	19.0793	19.6136	19.9226	20.0248	20.0096	19.7990	19.0854	18.1211	17.3212 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.9026	0.8554	0.7688	0.6473	0.4900	0.3474	0.3882	0.5999	0.8079	0.9059	0.9415 (94)
Useful gains	735.6862	842.8314	900.4432	914.5502	819.6015	612.4077	415.3892	432.5978	613.4854	713.3261	709.1754	703.8837 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1647.4473	1623.2443	1493.7054	1278.1661	993.6751	668.3363	430.0351	453.2400	715.5902	1065.4716	1383.8615	1647.5657 (97)
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98a)
Space heating requirement - total per year (kWh/year)												3485.3586
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3485.3586
Space heating per m2										(98c) / (4) =		26.1664 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Efficiency of main space heating system 1 (in %)

88.6000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	765.6323	591.9159	498.1795	295.4893	146.1747	0.0000	0.0000	0.0000	0.0000	295.7068	548.2776	792.4373 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5879	86.3882	86.0169	85.3406	84.0607	80.7000	80.7000	80.7000	80.7000	85.3326	86.2837	86.6588 (217)
Fuel for water heating, kWh/month	243.8519	215.0056	227.0670	196.2542	189.5497	173.8948	169.0133	178.1886	182.7993	197.2460	212.7187	240.4095 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.2974	-43.3211	-70.5575	-87.8669	-100.5010	-95.7200	-94.0595	-85.5415	-70.9764	-52.7117	-31.3558	-22.8726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7413	-23.6118	-55.6940	-96.8927	-139.6238	-144.8224	-141.4485	-112.6191	-73.2446	-36.3165	-13.6210	-7.4004 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	3933.8133	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.7000	
Water heating fuel used	2425.9987	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	58.9956	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	144.9956	(231)
Electricity for lighting (calculated in Appendix L)	262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1637.8174	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5129.1362	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3933.8133	0.2100	826.1008 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9987	0.2100	509.4597 (264)
Space and water heating			1335.5605 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	0.1326	-103.8058
PV Unit electricity exported	-855.0362	0.1224	-104.6445
Total			-208.4502 (269)
Total CO2, kg/year			1185.0588 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.9000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3933.8133	1.1300	4445.2091 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9987	1.1300	2741.3786 (278)
Space and water heating			7186.5877 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	1.4900	-1166.3460
PV Unit electricity exported	-855.0362	0.4491	-383.9712
Total			-1550.3172 (283)
Total Primary energy kWh/year			6257.7080 (286)
Dwelling Primary energy Rate (DPER)			46.9800 (287)

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

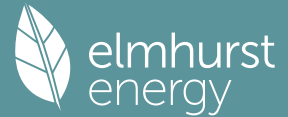
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)

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Pressure test		Yes
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3776	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3210 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771
	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0928		(33)
Party Wall			43.4800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.0826 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	17.9200	0.0500	0.8960
E4 Jamb	37.1500	0.0500	1.8575
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.1200	0.5580
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0600	0.0708
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0156 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 75.1084 (37)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779

 Heat transfer coeff (38)m 135.4918 135.1554 134.8257 133.2772 132.9875 131.6387 131.6387 131.3890 132.1582 132.9875 133.5736 134.1863 (39)
 Average = Sum(39)m / 12 = 133.2758

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0172	1.0147	1.0122	1.0006	0.9984	0.9883	0.9883	0.9864	0.9922	0.9984	1.0028	1.0074
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
Hot water usage for baths	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for other uses	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Average daily hot water use (litres/day)	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
													136.7047 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2270.6369
Water storage loss:	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2561.0168 (64)
Electric shower(s)													2561 (64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186 (72)
Total internal gains	649.7918	666.9541	637.0879	614.0463	580.6224	555.5767	532.5524	533.1488	550.6125	573.3338	610.7261	635.0211 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					7.1300	19.6403		0.6300	0.7000	0.7700		42.7965 (76)	
South					4.9500	46.7521		0.6300	0.7000	0.7700		70.7258 (78)	
West					9.6300	19.6403		0.6300	0.7000	0.7700		57.8023 (80)	
West					1.1400	25.9287		0.6300	0.7000	1.0000		11.7319 (82)	
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301 (83)	
Total gains	832.8483	1003.0497	1148.7150	1313.9453	1409.7254	1394.5274	1335.0934	1239.5349	1128.8774	959.9785	834.7164	788.4512 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934
alpha	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662
util living area	0.9585	0.9324	0.8899	0.8054	0.6858	0.5358	0.4091	0.4519	0.6537	0.8521	0.9370	0.9637 (86)
MIT	18.5904	18.9565	19.4624	20.0821	20.5526	20.8414	20.9451	20.9264	20.7111	20.0636	19.2224	18.5320 (87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772 (88)
util rest of house	0.9528	0.9235	0.8753	0.7798	0.6445	0.4753	0.3328	0.3739	0.5962	0.8264	0.9272	0.9587 (89)
MIT 2	17.2334	17.6953	18.3289	19.0932	19.6458	19.9644	20.0600	20.0478	19.8370	19.0895	18.0431	17.1643 (90)
Living area fraction	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9291	0.8942	0.8427	0.7507	0.6271	0.4720	0.3371	0.3771	0.5843	0.7955	0.8989	0.9368 (94)
Useful gains	773.8173	896.9516	968.0511	986.3689	883.9748	658.1591	450.0543	467.3885	659.5640	763.6535	750.3385	738.6282 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1769.4619	1745.1944	1609.0412	1370.7655	1067.8954	716.8913	466.3010	490.0119	768.9325	1141.0418	1476.3508	1756.6847 (97)
Space heating kWh	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98a)
Space heating requirement - total per year (kWh/year)												3762.2177
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3762.2177
Space heating per m2										(98c) / (4) =		28.2449 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	801.6879	616.9039	516.1219	299.5298	148.0919	0.0000	0.0000	0.0000	0.0000	303.8711	565.7239	819.7338 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5392	86.2944	85.8407	84.9773	83.5494	80.3000	80.3000	80.3000	80.3000	84.9813	86.1232	80.3000	(216)
Fuel for water heating, kWh/month	292.5474	259.3517	277.0794	246.7204	243.5920	228.7993	226.2980	235.1710	237.5862	249.8188	261.4254	289.2833	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.1677	-61.7179	-89.9276	-102.4962	-111.6343	-104.5174	-103.1520	-96.7982	-85.8266	-71.1252	-47.7335	-37.2148	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8427	-46.2205	-92.3962	-139.5739	-185.3726	-186.6282	-184.5107	-155.9169	-113.8217	-66.4561	-29.2719	-17.2586	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4071.6642	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3047.6729	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5272.9017	(238)

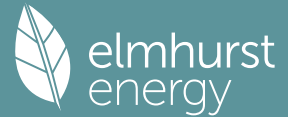
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4071.6642	0.2100	855.0495 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3047.6729	0.2100	640.0113 (264)
Space and water heating			1495.0608 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	0.1343	-128.3138
PV Unit electricity exported	-1239.2700	0.1257	-155.7964
Total			-284.1101 (269)
Total CO2, kg/year			1260.7157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4071.6642	1.1300	4600.9805 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3047.6729	1.1300	3443.8704 (278)
Space and water heating			8044.8509 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	1.4964	-1429.5231
PV Unit electricity exported	-1239.2700	0.4615	-571.8681
Total			-2001.3912 (283)
Total Primary energy kWh/year			6575.6488 (286)
Target Primary Energy Rate (TPER)			49.3700 (287)

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Property Reference	77942-01				Issued on Date	18/12/2024	
Assessment Reference	001			Prop Type Ref	NDS-33 (Semi)		
Property	Plot 1, Chapel Street, MANCHESTER, M19 3QB						
SAP Rating	93 A		DER	8.90		TER	9.46
Environmental	91 B		% DER < TER				5.92
CO ₂ Emissions (t/year)	1.13		DFEE	33.34		TFEE	33.64
Compliance Check	See BREL		% DFEE < TFEE				0.89
% DPER < TPER	4.84		DPER	46.98		TPER	49.37
Assessor Details	Mr. Paul Goddard					Assessor ID	B342-0001
Client							

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

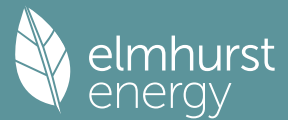
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1276 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3276	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.0831			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12798.1999	(34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.0826 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	17.9200	0.0500	0.8960
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	37.1500	0.0500	1.8575
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0800	0.0944
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	13.7602 (36)
Total fabric heat loss	(33) + (36) + (36a) =	73.8433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588 (38)
Heat transfer coeff	132.0846	131.8315	131.5833	130.4177	130.1996	129.1844	129.1844	128.9964	129.5755	130.1996	130.6408	131.1020 (39)
Average = Sum(39)m / 12 =												130.4167

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9916	0.9897	0.9879	0.9791	0.9775	0.9699	0.9699	0.9684	0.9728	0.9775	0.9808	0.9842 (40)
HLP (average)												0.9791
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Energy content (annual)										Total = Sum(45)m =		1154.2766
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
												663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

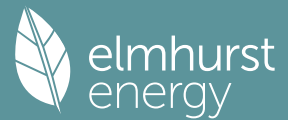
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	578.3220	596.8424	570.1117	554.6307	525.6543	508.3060	488.4925	486.9482	501.8261	516.3071	546.4829	564.5800 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	

East	7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (76)
South	4.9500	46.7521	0.3300	0.0000	0.7700	58.8045 (78)
West	9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (80)
West	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847	(83)
Total gains	732.5007	880.2434	1002.2413	1146.7503	1227.8270	1219.1168	1168.3339	1084.8482	990.5773	842.5336	735.1995	693.7648	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.9150	26.9667	27.0175	27.2590	27.3047	27.5192	27.5192	27.5593	27.4362	27.3047	27.2124	27.1167	
alpha	2.7943	2.7978	2.8012	2.8173	2.8203	2.8346	2.8346	2.8373	2.8291	2.8203	2.8142	2.8078	
util living area	0.9688	0.9483	0.9144	0.8422	0.7331	0.5844	0.4519	0.4973	0.6999	0.8816	0.9517	0.9729	(86)
MIT	18.5145	18.8592	19.3505	19.9780	20.4810	20.8086	20.9323	20.9098	20.6641	19.9790	19.1381	18.4553	(87)
Th 2	20.0903	20.0919	20.0935	20.1008	20.1021	20.1085	20.1085	20.1097	20.1061	20.1021	20.0994	20.0965	(88)
util rest of house	0.9645	0.9412	0.9024	0.8197	0.6943	0.5232	0.3713	0.4158	0.6445	0.8597	0.9439	0.9691	(89)
MIT 2	17.7991	18.1397	18.6224	19.2316	19.6988	19.9850	20.0759	20.0638	19.8722	19.2456	18.4242	17.7447	(90)
Living area fraction	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108	(91)
MIT	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9498	0.9219	0.8793	0.7965	0.6784	0.5198	0.3757	0.4190	0.6335	0.8363	0.9254	0.9557	(94)
Useful gains	695.7035	811.5369	881.2811	913.3691	833.0149	633.6490	438.9874	454.5606	627.5077	704.5851	680.3337	663.0400	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1791.8125	1754.2302	1604.0148	1356.4710	1050.9060	705.5445	459.3195	482.7570	757.4674	1134.5342	1488.0730	1784.4016	(97)
Space heating kWh	815.5051	633.4899	537.7139	319.0334	162.1109	0.0000	0.0000	0.0000	0.0000	319.8821	581.5723	834.2930	(98a)
Space heating requirement - total per year (kWh/year)												4203.6007	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.5051	633.4899	537.7139	319.0334	162.1109	0.0000	0.0000	0.0000	0.0000	319.8821	581.5723	834.2930	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4203.6007	
Space heating per m2										(98c) / (4) =		31.5586	(99)

8c. Space cooling requirement

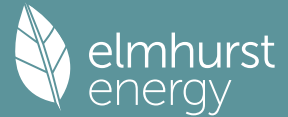
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1214.3336	955.9648	980.3729	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7751	0.8372	0.8074	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	941.1984	800.3441	791.5641	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1342.4679	1286.9138	1194.4815	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	288.9141	362.0078	299.7705	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	72.2285	90.5020	74.9426	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												237.6731 (107)
Energy for space heating												31.5586 (99)
Energy for space cooling												1.7843 (108)
Total												33.3429 (109)
Fabric Energy Efficiency (DFEE)												33.3 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)	
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)	
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)	

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.3776 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3210 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)

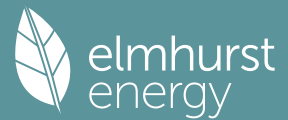
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0928			(33)
Party Wall			43.4800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								96.0826 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				17.9200	0.0500	0.8960		
E3 Sill				17.9200	0.0500	0.8960		
E4 Jamb				37.1500	0.0500	1.8575		
E5 Ground floor (normal)				21.5800	0.1600	3.4528		
E16 Corner (normal)				21.1700	0.0900	1.9053		
E18 Party wall between dwellings				14.1100	0.0600	0.8466		
P1 Party wall - Ground floor				8.7000	0.0800	0.6960		
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200	0.5580		
E6 Intermediate floor within a dwelling				21.5800	0.0000	0.0000		
E11 Eaves (insulation at rafter level)				13.5900	0.0400	0.5436		
E13 Gable (insulation at rafter level)				11.5900	0.0800	0.9272		
R5 Ridge (inverted)				5.7100	0.0400	0.2284		
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800	0.4696		
R4 Ridge (vaulted ceiling)				13.1800	0.0800	1.0544		
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900	-0.6354		
R1 Head of roof window				1.1800	0.0800	0.0944		
R2 Sill of roof window				1.1800	0.0600	0.0708		
R3 Jamb of roof window				1.9300	0.0800	0.1544		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.0156 (36)
Point Thermal bridges								(36a) = 0.0000
Total fabric heat loss								(33) + (36) + (36a) = 75.1084 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)	
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths													
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)	
Hot water usage for other uses													
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)	
Average daily hot water use (litres/day)													69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)	
Energy content (annual)	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1154.2766
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	

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Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
WWHRS	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (64)
12Total per year (kWh/year)												981.1351 (64a)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	578.3220	596.8424	570.1117	554.6307	525.6543	508.3060	488.4925	486.9482	501.8261	516.3071	546.4829	564.5800	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				7.1300	19.6403		0.6300		0.7000		0.7700		42.7965 (76)
South				4.9500	46.7521		0.6300		0.7000		0.7700		70.7258 (78)
West				9.6300	19.6403		0.6300		0.7000		0.7700		57.8023 (80)
West				1.1400	25.9287		0.6300		0.7000		1.0000		11.7319 (82)
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301	(83)
Total gains	761.3786	932.9380	1081.7387	1254.5297	1354.7574	1347.2567	1291.0336	1193.3344	1080.0909	902.9518	770.4732	718.0101	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934	
alpha	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662	
util living area	0.9662	0.9421	0.9021	0.8196	0.7013	0.5497	0.4211	0.4663	0.6713	0.8676	0.9471	0.9708	(86)
MIT	18.4873	18.8638	19.3858	20.0324	20.5248	20.8305	20.9409	20.9203	20.6898	20.0063	19.1357	18.4283	(87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772	(88)
util rest of house	0.9615	0.9342	0.8886	0.7950	0.6605	0.4887	0.3432	0.3868	0.6142	0.8438	0.9386	0.9667	(89)
MIT 2	17.7580	18.1296	18.6411	19.2666	19.7198	19.9854	20.0652	20.0549	19.8769	19.2570	18.4089	17.7050	(90)
Living area fraction	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723	(91)
MIT	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9457	0.9136	0.8643	0.7721	0.6464	0.4866	0.3480	0.3905	0.6047	0.8199	0.9188	0.9524	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1832.6277	1797.2693	1646.2606	1391.1154	1076.4795	719.2732	466.8710	490.7798	773.4523	1160.5380	1519.5909	1821.2117	(97)
Space heating kWh	827.7471	635.0209	529.2226	304.2197	149.3791	0.0000	0.0000	0.0000	0.0000	312.6578	584.3828	846.1946	(98a)
Space heating requirement - total per year (kWh/year)												4188.8246	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	827.7471	635.0209	529.2226	304.2197	149.3791	0.0000	0.0000	0.0000	0.0000	312.6578	584.3828	846.1946	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4188.8246	
Space heating per m ²												31.4476	(99)

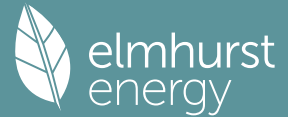
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----- 8c. Space cooling requirement -----

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1237.4041	974.1266	998.5561	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8015	0.8583	0.8300	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	991.7561	836.0981	828.8413	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1492.2418	1430.3290	1321.2834	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	360.3497	442.1078	366.3769	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	90.0874	110.5269	91.5942	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												292.2086 (107)
Energy for space heating												31.4476 (99)
Energy for space cooling												2.1938 (108)
Total												33.6414 (109)
Fabric Energy Efficiency (TFEE)												33.6 (109)

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Property Reference	77942-01			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 1, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.13	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

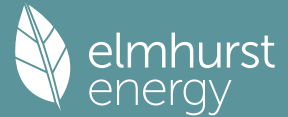
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199 (29a)
PIU	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0831		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

(28)...(30) + (32) + (32a)...(32e) = 12798.1999 (34)
96.0826 (35)

List of Thermal Bridges

K1 Element
E2 Other lintels (including other steel lintels)
E3 Sill
E4 Jamb
E5 Ground floor (normal)
E6 Corner (normal)
E18 Party wall between dwellings
P1 Party wall - Ground floor
P4 Party wall - Roof (insulation at ceiling level)
E6 Intermediate floor within a dwelling
E11 Eaves (insulation at rafter level)
E13 Gable (insulation at rafter level)
R5 Ridge (inverted)
P5 Party wall - Roof (insulation at rafter level)
R4 Ridge (vaulted ceiling)
E17 Corner (inverted - internal area greater than external area)
R1 Head of roof window
R2 Sill of roof window
R3 Jamb of roof window

Length	Psi-value	Total
17.9200	0.0500	0.8960
17.9200	0.0500	0.8960
37.1500	0.0500	1.8575
21.5800	0.1600	3.4528
21.1700	0.0900	1.9053
14.1100	0.0600	0.8466
8.7000	0.0800	0.6960
4.6500	0.0600	0.2790
21.5800	0.0000	0.0000
13.5900	0.0400	0.5436
11.5900	0.0800	0.9272
5.7100	0.0400	0.2284
5.8700	0.0800	0.4696
13.1800	0.0800	1.0544
7.0600	-0.0900	-0.6354
1.1800	0.0800	0.0944
1.1800	0.0800	0.0944
1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

(36a) = 0.0000
(33) + (36) + (36a) = 73.8433 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(39)
Average = Sum(39)m / 12 =	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	(40)
HLP (average)												0.9427	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9028 (42)
Hot water usage for mixer showers 72.8908 71.7954 70.1992 67.1451 64.8913 62.3778 60.9492 62.5333 64.2698 66.9685 70.0882 72.6116 (42a)
Hot water usage for baths 31.4687 31.0013 30.3432 29.1297 28.2211 27.2135 26.6693 27.3228 28.0344 29.1125 30.3510 31.3623 (42b)
Hot water usage for other uses 44.3579 42.7449 41.1319 39.5189 37.9059 36.2929 36.2929 37.9059 39.5189 41.1319 42.7449 44.3579 (42c)
Average daily hot water use (litres/day) 136.7047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total = Sum(45)m =		2270.6369	(45)
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2047.2598	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

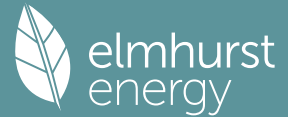
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	633.2020	650.3745	620.5097	597.4465	564.0111	538.9493	515.9071	516.5077	533.9762	556.7121	594.1231	618.4277	(73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East		7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (76)
South		4.9500	46.7521	0.3300	0.0000	0.7700	58.8045 (78)
West		9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (80)
West		1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847 (83)
Total gains	787.3807	933.7755	1052.6393	1189.5662	1266.1838	1249.7601	1195.7485	1114.4077	1022.7274	882.9386	782.8398	747.6124 (84)

7. Mean internal temperature (heating season)

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

21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125
alpha	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875
util living area	0.9622	0.9391	0.9016	0.8255	0.7120	0.5648	0.4339	0.4777	0.6784	0.8662	0.9430	0.9671 (86)
MIT	18.7334	19.0628	19.5249	20.0906	20.5494	20.8346	20.9431	20.9235	20.7079	20.0842	19.2956	18.6536 (87)
Th 2	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314 (88)
util rest of house	0.9572	0.9312	0.8886	0.8022	0.6731	0.5053	0.3572	0.3998	0.6234	0.8429	0.9342	0.9627 (89)
MIT 2	17.4511	17.8663	18.4456	19.1411	19.6831	19.9946	20.0961	20.0813	19.8712	19.1485	18.1661	17.3501 (90)
Living area fraction									fLA = Living area /	(4) =		0.0929 (91)
MIT	17.5703	17.9775	18.5459	19.2293	19.7636	20.0726	20.1748	20.1596	19.9490	19.2354	18.2711	17.4712 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4203	17.8275	18.3959	19.0793	19.6136	19.9226	20.0248	20.0096	19.7990	19.0854	18.1211	17.3212 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.9026	0.8554	0.7688	0.6473	0.4900	0.3474	0.3882	0.5999	0.8079	0.9059	0.9415 (94)
Useful gains	735.6862	842.8314	900.4432	914.5502	819.6015	612.4077	415.3892	432.5978	613.4854	713.3261	709.1754	703.8837 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1647.4473	1623.2443	1493.7054	1278.1661	993.6751	668.3363	430.0351	453.2400	715.5902	1065.4716	1383.8615	1647.5657 (97)
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98a)
Space heating requirement - total per year (kWh/year)												3485.3586
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3485.3586
Space heating per m2										(98c) / (4) =		26.1664 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)

0.0000 (201)

Fraction of space heat from main system(s)

1.0000 (202)

Efficiency of main space heating system 1 (in %)

88.6000 (206)

Efficiency of main space heating system 2 (in %)

0.0000 (207)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	765.6323	591.9159	498.1795	295.4893	146.1747	0.0000	0.0000	0.0000	0.0000	295.7068	548.2776	792.4373 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5879	86.3882	86.0169	85.3406	84.0607	80.7000	80.7000	80.7000	80.7000	85.3326	86.2837	86.6588 (217)
Fuel for water heating, kWh/month	243.8519	215.0056	227.0670	196.2542	189.5497	173.8948	169.0133	178.1886	182.7993	197.2460	212.7187	240.4095 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.2974	-43.3211	-70.5575	-87.8669	-100.5010	-95.7200	-94.0595	-85.5415	-70.9764	-52.7117	-31.3558	-22.8726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-9.7413	-23.6118	-55.6940	-96.8927	-139.6238	-144.8224	-141.4485	-112.6191	-73.2446	-36.3165	-13.6210	-7.4004 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	3933.8133	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.7000	
Water heating fuel used	2425.9987	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	58.9956	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	144.9956	(231)
Electricity for lighting (calculated in Appendix L)	262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1637.8174	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5129.1362	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3933.8133	0.2100	826.1008 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9987	0.2100	509.4597 (264)
Space and water heating			1335.5605 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	0.1326	-103.8058
PV Unit electricity exported	-855.0362	0.1224	-104.6445
Total			-208.4502 (269)
Total CO2, kg/year			1185.0588 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.9000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3933.8133	1.1300	4445.2091 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9987	1.1300	2741.3786 (278)
Space and water heating			7186.5877 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	1.4900	-1166.3460
PV Unit electricity exported	-855.0362	0.4491	-383.9712
Total			-1550.3172 (283)
Total Primary energy kWh/year			6257.7080 (286)
Dwelling Primary energy Rate (DPER)			46.9800 (287)

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

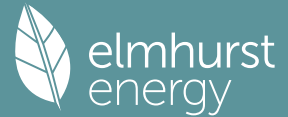
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)

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Pressure test		Yes
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3776	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3210 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771
	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	61.0928	(33)
Party Wall			43.4800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.0826 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	17.9200	0.0500	0.8960
E4 Jamb	37.1500	0.0500	1.8575
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.1200	0.5580
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0600	0.0708
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0156 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 75.1084 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan 60.3834 Feb 60.0470 Mar 59.7173 Apr 58.1688 May 57.8791 Jun 56.5303 Jul 56.5303 Aug 56.2806 Sep 57.0499 Oct 57.8791 Nov 58.4652 Dec 59.0779 (38)
 Heat transfer coeff 135.4918 135.1554 134.8257 133.2772 132.9875 131.6387 131.6387 131.3890 132.1582 132.9875 133.5736 134.1863 (39)
 Average = Sum(39)m / 12 = 133.2758

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0172	1.0147	1.0122	1.0006	0.9984	0.9883	0.9883	0.9864	0.9922	0.9984	1.0028	1.0074
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
Hot water usage for baths	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for other uses	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Average daily hot water use (litres/day)	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
													136.7047 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Total storage loss													
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
WWHRS	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
PV diverter	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64)
Total per year (kWh/year)	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Electric shower(s)													2561.0168 (64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328 (68)
Pumps, fans	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Total internal gains	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186 (72)
	649.7918	666.9541	637.0879	614.0463	580.6224	555.5767	532.5524	533.1488	550.6125	573.3338	610.7261	635.0211 (73)

6. Solar gains

[Jan]												
			Area	Solar flux	g	FF						Gains
			m2	Table 6a	Specific data	Specific data						W
				W/m2	or Table 6b	or Table 6c				Access		
									factor			
									Table 6d			
East			7.1300	19.6403	0.6300	0.7000			0.7700			42.7965 (76)
South			4.9500	46.7521	0.6300	0.7000			0.7700			70.7258 (78)
West			9.6300	19.6403	0.6300	0.7000			0.7700			57.8023 (80)
West			1.1400	25.9287	0.6300	0.7000			1.0000			11.7319 (82)
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301 (83)
Total gains	832.8483	1003.0497	1148.7150	1313.9453	1409.7254	1394.5274	1335.0934	1239.5349	1128.8774	959.9785	834.7164	788.4512 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934
util living area	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662
	0.9585	0.9324	0.8899	0.8054	0.6858	0.5358	0.4091	0.4519	0.6537	0.8521	0.9370	0.9637 (86)
MIT	18.5904	18.9565	19.4624	20.0821	20.5526	20.8414	20.9451	20.9264	20.7111	20.0636	19.2224	18.5320 (87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772 (88)
util rest of house	0.9528	0.9235	0.8753	0.7798	0.6445	0.4753	0.3328	0.3739	0.5962	0.8264	0.9272	0.9587 (89)
MIT 2	17.2334	17.6953	18.3289	19.0932	19.6458	19.9644	20.0600	20.0478	19.8370	19.0895	18.0431	17.1643 (90)
Living area fraction	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9291	0.8942	0.8427	0.7507	0.6271	0.4720	0.3371	0.3771	0.5843	0.7955	0.8989	0.9368 (94)
Ext temp.	773.8173	896.9516	968.0511	986.3689	883.9748	658.1591	450.0543	467.3885	659.5640	763.6535	750.3385	738.6282 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1769.4619	1745.1944	1609.0412	1370.7655	1067.8954	716.8913	466.3010	490.0119	768.9325	1141.0418	1476.3508	1756.6847 (97)
Space heating requirement - total per year (kWh/year)	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98a)
Solar heating kWh												3762.2177
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3762.2177
Space heating per m2										(98c) / (4) =		28.2449 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98)
Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating efficiency (main heating system 2)	801.6879	616.9039	516.1219	299.5298	148.0919	0.0000	0.0000	0.0000	0.0000	303.8711	565.7239	819.7338 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
Efficiency of water heater	86.5392	86.2944	85.8407	84.9773	83.5494	80.3000	80.3000	80.3000	80.3000	84.9813	86.1232	80.3000 (216)
Fuel for water heating, kWh/month	292.5474	259.3517	277.0794	246.7204	243.5920	228.7993	226.2980	235.1710	237.5862	249.8188	261.4254	86.5951 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.1677	-61.7179	-89.9276	-102.4962	-111.6343	-104.5174	-103.1520	-96.7982	-85.8266	-71.1252	-47.7335	-37.2148 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-21.8427	-46.2205	-92.3962	-139.5739	-185.3726	-186.6282	-184.5107	-155.9169	-113.8217	-66.4561	-29.2719	-17.2586 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4071.6642 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												3047.6729 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												262.1460 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2194.5813 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5272.9017 (238)

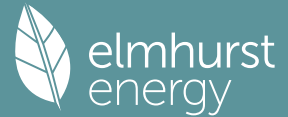
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4071.6642	0.2100	855.0495 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3047.6729	0.2100	640.0113 (264)
Space and water heating			1495.0608 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	0.1343	-128.3138
PV Unit electricity exported	-1239.2700	0.1257	-155.7964
Total			-284.1101 (269)
Total CO2, kg/year			1260.7157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4071.6642	1.1300	4600.9805 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3047.6729	1.1300	3443.8704 (278)
Space and water heating			8044.8509 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	1.4964	-1429.5231
PV Unit electricity exported	-1239.2700	0.4615	-571.8681
Total			-2001.3912 (283)
Total Primary energy kWh/year			6575.6488 (286)
Target Primary Energy Rate (TPER)			49.3700 (287)

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Property Reference	77942-02				Issued on Date	18/12/2024		
Assessment Reference	001			Prop Type Ref	NDS-33 (Semi)			
Property	Plot 2, Chapel Street, MANCHESTER, M19 3QB							
SAP Rating	93 A		DER	8.86		TER	9.51	
Environmental	91 B		% DER < TER				6.83	
CO ₂ Emissions (t/year)	1.13		DFEE	32.78		TFEE	33.33	
Compliance Check	See BREL		% DFEE < TFEE				1.64	
% DPER < TPER	5.63		DPER	46.86		TPER	49.66	
Assessor Details	Mr. Paul Goddard					Assessor ID	B342-0001	
Client								

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
List of Thermal Bridges 96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)
Heat transfer coeff 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 (39)
Average = Sum(39)m / 12 = 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 (39)

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (40)
HLP (average) 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 (40)
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

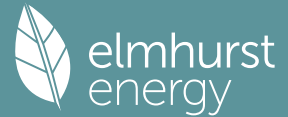
Assumed occupancy 2.9028 (42)
Hot water usage for mixer showers 72.8908 71.7954 70.1992 67.1451 64.8913 62.3778 60.9492 62.5333 64.2698 66.9685 70.0882 72.6116 (42a)
Hot water usage for baths 31.4687 31.0013 30.3432 29.1297 28.2211 27.2135 26.6693 27.3228 28.0344 29.1125 30.3510 31.3623 (42b)
Hot water usage for other uses 44.3579 42.7449 41.1319 39.5189 37.9059 36.2929 36.2929 37.9059 39.5189 41.1319 42.7449 44.3579 (42c)
Average daily hot water use (litres/day) 136.7047 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (44)
Energy conte 148.7174 145.5417 141.6743 135.7937 131.0182 125.8842 123.9113 127.7620 131.8231 137.2129 143.1841 148.3318 (44)
Energy content (annual) 235.5321 207.2494 217.7481 185.8948 176.3757 154.7893 149.8600 158.1961 162.5511 186.1966 203.9920 232.2517 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$ Total = Sum(45)m = 2270.6369
Water storage loss: 35.3298 31.0874 32.6622 27.8842 26.4564 23.2184 22.4790 23.7294 24.3827 27.9295 30.5988 34.8378 (46)
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Combi loss 1.5879 1.4614 1.6221 1.5076 1.5237 1.4280 1.4227 1.4351 1.4024 1.4929 1.4986 1.5768 (61)
Total heat required for water heating calculated for each month 237.1199 208.7108 219.3702 187.4024 177.8994 156.2174 151.2827 159.6311 163.9535 187.6895 205.4906 233.8285 (62)
WWHRS -25.9736 -22.9713 -24.0542 -19.9179 -18.5627 -15.8843 -14.8890 -15.8329 -16.4345 -19.3744 -21.9489 -25.4927 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h 211.1463 185.7395 195.3160 167.4846 159.3367 140.3331 136.3937 143.7982 147.5190 168.3151 183.5417 208.3358 (64)
Total per year (kWh/year) = Sum(64)m = 2047.2598 (64)
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month 78.7114 69.2758 72.8068 62.1869 59.0259 51.8245 50.1841 52.9590 54.3988 62.2836 68.2020 77.6179 (65)

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

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 164.1666 181.7559 164.1666 169.6389 164.1666 169.6389 164.1666 164.1666 169.6389 164.1666 169.6389 164.1666 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 301.5374 304.6664 296.7814 279.9952 258.8055 238.8902 225.5856 222.4566 230.3416 247.1279 268.3175 288.2328 (68)
Pumps, fans 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 (69)
Losses e.g. evaporation (negative values) (Table 5) 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Water heating gains (Table 5) -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 (71)
Total internal gains 105.7949 103.0889 97.8586 86.3707 79.3358 71.9784 67.4518 71.1814 75.5539 83.7145 94.7250 104.3251 (72)
641.0415 659.0538 628.3492 605.5473 571.8505 547.0500 523.7465 524.3472 542.0769 564.5515 602.2239 626.2671 (73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

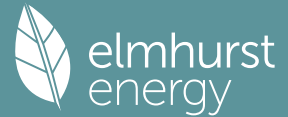
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4384 (37)

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

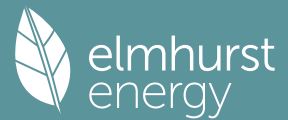
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total =	Sum(45)m =	2270.6369	
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)								Total per year (kWh/year) =	Sum(64)m =			2561.0168	(64)
												2561	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West				9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West				1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²												28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

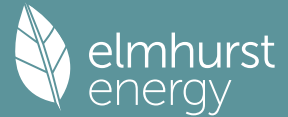
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4089.6796	0.2100	858.8327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3046.8825	0.2100	639.8453	(264)
Space and water heating			1498.6780	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	275.2920	0.1443	39.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582	
PV Unit electricity exported	-1238.1848	0.1257	-155.6511	
Total			-284.1094	(269)
Total CO2, kg/year			1266.2311	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4089.6796	1.1300	4621.3379	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773	(278)
Space and water heating			8064.3152	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	275.2920	1.5338	422.2520	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421	
PV Unit electricity exported	-1238.1848	0.4614	-571.3347	
Total			-2002.4768	(283)
Total Primary energy kWh/year			6614.1912	(286)
Target Primary Energy Rate (TPER)			49.6600	(287)

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Property Reference	77942-02				Issued on Date	18/12/2024		
Assessment Reference	001			Prop Type Ref	NDS-33 (Semi)			
Property	Plot 2, Chapel Street, MANCHESTER, M19 3QB							
SAP Rating	93 A		DER	8.86		TER	9.51	
Environmental	91 B		% DER < TER				6.83	
CO ₂ Emissions (t/year)	1.13		DFEE	32.78		TFEE	33.33	
Compliance Check	See BREL		% DFEE < TFEE				1.64	
% DPER < TPER	5.63		DPER	46.86		TPER	49.66	
Assessor Details	Mr. Paul Goddard					Assessor ID	B342-0001	
Client								

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

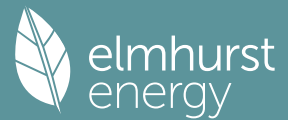
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3276 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12842.7499 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0800	0.0944
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588
Heat transfer coeff	126.3652	126.1120	125.8639	124.6983	124.4802	123.4650	123.4650	123.2770	123.8560	124.4802	124.9214	125.3826
Average = Sum(39)m / 12 =												124.6972

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9487	0.9468	0.9449	0.9362	0.9345	0.9269	0.9269	0.9255	0.9299	0.9345	0.9378	0.9413
HLP (average)												0.9362
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596
Energy content (annual)										Total = Sum(45)m =		1154.2766 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (64)
12Total per year (kWh/year)												
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734
												58.3734 (64a)
												663.9941 (64a)
Heat gains from water heating, kWh/month												
40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873	39.7873 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	
East	7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (76)
West	9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (80)
West	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768 (86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151 (87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325 (88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735 (89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278 (90)
Living area fraction									FLA = Living area /	(4) =		0.0929 (91)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617 (94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994 (97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98a)
Space heating requirement - total per year (kWh/year)												4183.1031
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031
Space heating per m2										(98c) / (4) =		31.4047 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction												
Intermittency factor (Table 10b)									fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												183.5936 (107)
Energy for space cooling												31.4047 (99)
Total												1.3783 (108)
Fabric Energy Efficiency (DFEE)												32.7830 (109)
												32.8 (109)

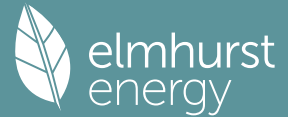
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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											m3 per hour		
Number of open chimneys	0 * 80 =											0.0000	(6a)
Number of open flues	0 * 20 =											0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000	(6d)
Number of flues attached to other heater	0 * 35 =											0.0000	(6e)
Number of blocked chimneys	0 * 20 =											0.0000	(6f)
Number of intermittent extract fans	4 * 10 =											40.0000	(7a)
Number of passive vents	0 * 10 =											0.0000	(7b)
Number of flueless gas fires	0 * 40 =											0.0000	(7c)
Air changes per hour													
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =											0.1276	(8)
Pressure test	Yes												
Pressure Test Method	Blower Door												
Measured/design AP50	5.0000											(17)	
Infiltration rate	0.3776											(18)	
Number of sides sheltered	2											(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3210	(21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

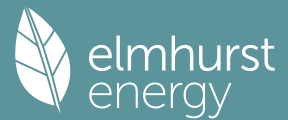
List of Thermal Bridges												
K1 Element						Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)						13.8300	0.0500	0.6915				
E3 Sill						13.8300	0.0500	0.6915				
E4 Jamb						27.4700	0.0500	1.3735				
E5 Ground floor (normal)						21.5800	0.1600	3.4528				
E16 Corner (normal)						21.1700	0.0900	1.9053				
E18 Party wall between dwellings						14.1100	0.0600	0.8466				
P1 Party wall - Ground floor						8.7000	0.0800	0.6960				
P4 Party wall - Roof (insulation at ceiling level)						4.6500	0.1200	0.5580				
E6 Intermediate floor within a dwelling						21.5800	0.0000	0.0000				
E11 Eaves (insulation at rafter level)						13.5900	0.0400	0.5436				
E13 Gable (insulation at rafter level)						11.5900	0.0800	0.9272				
R5 Ridge (inverted)						5.7100	0.0400	0.2284				
P5 Party wall - Roof (insulation at rafter level)						5.8700	0.0800	0.4696				
R4 Ridge (vaulted ceiling)						13.1800	0.0800	1.0544				
E17 Corner (inverted - internal area greater than external area)						7.0600	-0.0900	-0.6354				
R1 Head of roof window						1.1800	0.0800	0.0944				
R2 Sill of roof window						1.1800	0.0600	0.0708				
R3 Jamb of roof window						1.9300	0.0800	0.1544				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.1226 (36)											
Point Thermal bridges	(36a) = 0.0000											
Total fabric heat loss	(33) + (36) + (36a) = 69.4384 (37)											

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779
Average = Sum(39)m / 12 =	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164
												(39)
												127.6059
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
												(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9028 (42)											
Hot water usage for mixer showers	0.0000											(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579
Average daily hot water use (litres/day)												(43)
												69.5018
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202
Energy content (annual)	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1154.2766											(44)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(45)
Water storage loss:												(46)

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				7.1300	19.6403	0.6300	0.7000		0.7700		42.7965 (76)	
West				9.6300	19.6403	0.6300	0.7000		0.7700		57.8023 (80)	
West				1.1400	25.9287	0.6300	0.7000		1.0000		11.7319 (82)	
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397	664.7359 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (91)
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

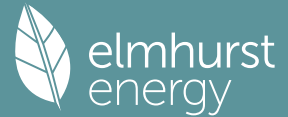
8c. Space cooling requirement

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Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

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Property Reference	77942-02			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 2, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised											0.5000 (23a)	
If mechanical ventilation											0.5000 (23b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(38)
Heat transfer coeff	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)
Average = Sum(39)m / 12 =													119.8454

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	(40)
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

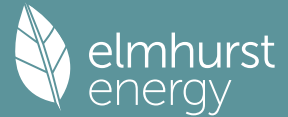
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)													Total = Sum(45)m = 2270.6369
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

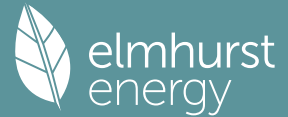
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

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

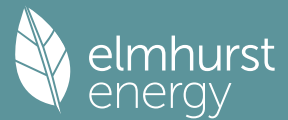
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)												2561.0168	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Ext temp.	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating requirement - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating per m ²	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
	(98c) / (4) =												28.3698 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

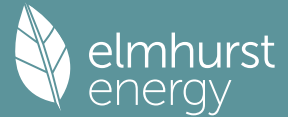
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-03				Issued on Date	18/12/2024
Assessment Reference	001		Prop Type Ref	NDS-33 (Semi)		
Property	Plot 3, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 96.4170 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges ($\text{Sum}(L \times \text{Psi})$) calculated using Appendix K) 12.8672 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25\text{m}) \times (5)$
(38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)
Heat transfer coeff 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 51.7216 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$ 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454 119.8454

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (40)
HLP (average) 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997 0.8997
Days in month 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

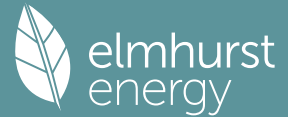
Assumed occupancy 2.9028 (42)
Hot water usage for mixer showers 72.8908 71.7954 70.1992 67.1451 64.8913 62.3778 60.9492 62.5333 64.2698 66.9685 70.0882 72.6116 (42a)
Hot water usage for baths 31.4687 31.0013 30.3432 29.1297 28.2211 27.2135 26.6693 27.3228 28.0344 29.1125 30.3510 31.3623 (42b)
Hot water usage for other uses 44.3579 42.7449 41.1319 39.5189 37.9059 36.2929 36.2929 37.9059 39.5189 41.1319 42.7449 44.3579 (42c)
Average daily hot water use (litres/day) 136.7047 (43)
Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (44)
Energy content (annual) 148.7174 145.5417 141.6743 135.7937 131.0182 125.8842 123.9113 127.7620 131.8231 137.2129 143.1841 148.3318 (44)
Distribution loss (46)m = $0.15 \times (45)\text{m}$ 235.5321 207.2494 217.7481 185.8948 176.3757 154.7893 149.8600 158.1961 162.5511 186.1966 203.9920 232.2517 (45)
Water storage loss: Total storage loss 35.3298 31.0874 32.6622 27.8842 26.4564 23.2184 22.4790 23.7294 24.3827 27.9295 30.5988 34.8378 (46)
If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 1.5879 1.4614 1.6221 1.5076 1.5237 1.4280 1.4227 1.4351 1.4024 1.4929 1.4986 1.5768 (61)
Total heat required for water heating calculated for each month 237.1199 208.7108 219.3702 187.4024 177.8994 156.2174 151.2827 159.6311 163.9535 187.6895 205.4906 233.8285 (62)
WWHRS -25.9736 -22.9713 -24.0542 -19.9179 -18.5627 -15.8843 -14.8890 -15.8329 -16.4345 -19.3744 -21.9489 -25.4927 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h 211.1463 185.7395 195.3160 167.4846 159.3367 140.3331 136.3937 143.7982 147.5190 168.3151 183.5417 208.3358 (64)
Total per year (kWh/year) = $\text{Sum}(64)\text{m} =$ 2047.2598 (64)
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)\text{m} =$ 0.0000 (64a)
Heat gains from water heating, kWh/month 78.7114 69.2758 72.8068 62.1869 59.0259 51.8245 50.1841 52.9590 54.3988 62.2836 68.2020 77.6179 (65)

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

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 145.1418 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 164.1666 181.7559 164.1666 169.6389 164.1666 169.6389 164.1666 164.1666 169.6389 164.1666 169.6389 164.1666 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 301.5374 304.6664 296.7814 279.9952 258.8055 238.8902 225.5856 222.4566 230.3416 247.1279 268.3175 288.2328 (68)
Pumps, fans 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 37.5142 (69)
Losses e.g. evaporation (negative values) (Table 5) 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Water heating gains (Table 5) -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 -116.1134 (71)
Total internal gains 105.7949 103.0889 97.8586 86.3707 79.3358 71.9784 67.4518 71.1814 75.5539 83.7145 94.7250 104.3251 (72)
641.0415 659.0538 628.3492 605.5473 571.8505 547.0500 523.7465 524.3472 542.0769 564.5515 602.2239 626.2671 (73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

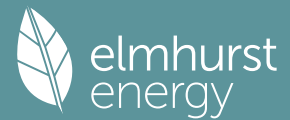
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = $1 - [0.075 \times (19)] = 0.8500$ (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

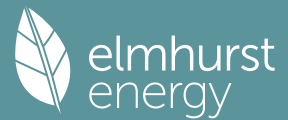
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)													
Distribution loss (46)m = $0.15 \times (45)m$													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64c)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)												2561.0168	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Ext temp.	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating requirement - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating per m ²	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

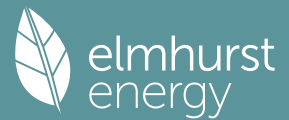
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-03				Issued on Date	18/12/2024		
Assessment Reference	001			Prop Type Ref	NDS-33 (Semi)			
Property	Plot 3, Chapel Street, MANCHESTER, M19 3QB							
SAP Rating	93 A		DER	8.86		TER	9.51	
Environmental	91 B		% DER < TER				6.83	
CO ₂ Emissions (t/year)	1.13		DFEE	32.78		TFEE	33.33	
Compliance Check	See BREL		% DFEE < TFEE				1.64	
% DPER < TPER	5.63		DPER	46.86		TPER	49.66	
Assessor Details	Mr. Paul Goddard					Assessor ID	B342-0001	
Client								

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1276 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	4.0000	(17)	
Infiltration rate	0.3276	(18)	
Number of sides sheltered	2	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2785 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12842.7499	(34)

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	W/m2				or Table 6b		or Table 6c		Table 6d		
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829	(76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594	(80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319	(82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722	(83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524	
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968	
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768	(86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151	(87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325	(88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735	(89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278	(90)
Living area fraction	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917	(91)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617	(94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994	(97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611	(98a)
Space heating requirement - total per year (kWh/year)												4183.1031	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031	
Space heating per m2												31.4047	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	221.9620	283.8194	228.5931	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												183.5936 (107)
Energy for space heating												31.4047 (99)
Energy for space cooling												1.3783 (108)
Total												32.7830 (109)
Fabric Energy Efficiency (DFEE)												32.8 (109)

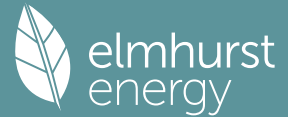
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
													Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3776 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3210 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							96.4170 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				13.8300	0.0500		0.6915
E3 Sill				13.8300	0.0500		0.6915
E4 Jamb				27.4700	0.0500		1.3735
E5 Ground floor (normal)				21.5800	0.1600		3.4528
E16 Corner (normal)				21.1700	0.0900		1.9053
E18 Party wall between dwellings				14.1100	0.0600		0.8466
P1 Party wall - Ground floor				8.7000	0.0800		0.6960
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200		0.5580
E6 Intermediate floor within a dwelling				21.5800	0.0000		0.0000
E11 Eaves (insulation at rafter level)				13.5900	0.0400		0.5436
E13 Gable (insulation at rafter level)				11.5900	0.0800		0.9272
R5 Ridge (inverted)				5.7100	0.0400		0.2284
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800		0.4696
R4 Ridge (vaulted ceiling)				13.1800	0.0800		1.0544
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900		-0.6354
R1 Head of roof window				1.1800	0.0800		0.0944
R2 Sill of roof window				1.1800	0.0600		0.0708
R3 Jamb of roof window				1.9300	0.0800		0.1544
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1226 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 69.4384 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9028 (42)											
Hot water usage for mixer showers	0.0000											
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579
Average daily hot water use (litres/day)	69.5018 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202
Energy content (annual)	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596
Distribution loss (46)m = 0.15 x (45)m	1154.2766											
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East						7.1300	19.6403	0.6300	0.7000	0.7700		42.7965 (76)
West						9.6300	19.6403	0.6300	0.7000	0.7700		57.8023 (80)
West						1.1400	25.9287	0.6300	0.7000	1.0000		11.7319 (82)
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397	664.7359 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction									fLA = Living area / (4) =			0.0929 (91)
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

8c. Space cooling requirement

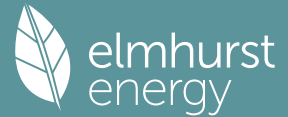
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 Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

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Property Reference	77942-03			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 3, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

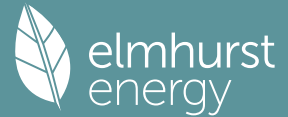
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity Cm = Sum(A x k)												(28)...(30) + (32) + (32a)...(32e) =	12842.7499 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													96.4170 (35)	
List of Thermal Bridges														
K1 Element												Length	Psi-value	Total
E2 Other lintels (including other steel lintels)												13.8300	0.0500	0.6915
E3 Sill												13.8300	0.0500	0.6915
E4 Jamb												27.4700	0.0500	1.3735
E5 Ground floor (normal)												21.5800	0.1600	3.4528
E16 Corner (normal)												21.1700	0.0900	1.9053
E18 Party wall between dwellings												14.1100	0.0600	0.8466
P1 Party wall - Ground floor												8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)												4.6500	0.0600	0.2790
E6 Intermediate floor within a dwelling												21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)												13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)												11.5900	0.0800	0.9272
R5 Ridge (inverted)												5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)												5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)												13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)												7.0600	-0.0900	-0.6354
R1 Head of roof window												1.8000	0.0800	0.0944
R2 Sill of roof window												1.8000	0.0800	0.0944
R3 Jamb of roof window												1.9300	0.0800	0.1544
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														12.8672 (36)
Point Thermal bridges													(36a) =	0.0000
Total fabric heat loss												(33) + (36) + (36a) =		68.1238 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)														
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(38)	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		

4. Water heating energy requirements (kWh/year)														

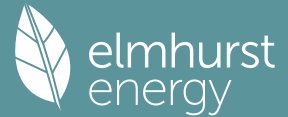
Assumed occupancy													2.9028 (42)	
Hot water usage for mixer showers														
	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths														
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses														
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)													136.7047 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)	
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)	
Energy content (annual)										Total = Sum(45)m =		2270.6369		
Distribution loss (46)m = 0.15 x (45)m														
	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:														
Total storage loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss														
	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)	
Total heat required for water heating calculated for each month														
	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)	
WWHRS														
	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)	
PV diverter														
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Solar input														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h														
	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)	
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m =	2047.2598 (64)	
Electric shower(s)													2047 (64)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)	
Heat gains from water heating, kWh/month														
	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)	

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

Metabolic gains (Table 5), Watts														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)	
Pumps, fans														
	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)														
	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)	
Water heating gains (Table 5)														
	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)	
Total internal gains														
	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)	

6. Solar gains														

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

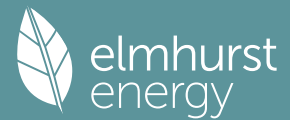
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =	56.3158	(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

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

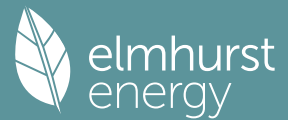
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64c)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)												2561.0168	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Ext temp.	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating requirement - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating per m ²	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

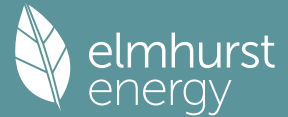
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-04				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 4, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

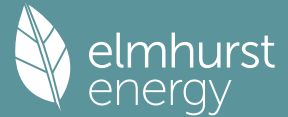
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	4.0000	(17)	
Infiltration rate	0.2000	(18)	
Number of sides sheltered	2	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

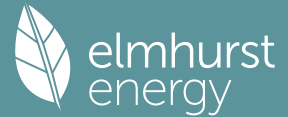
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

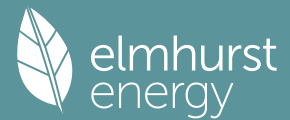
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4384 (37)

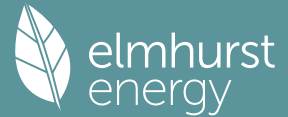
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779 (38)
Heat transfer coeff												
	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164 (39)
Average = Sum(39)m / 12 =												127.6059

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116 (42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)
Average daily hot water use (litres/day)												136.7047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318 (44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2270.6369
	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106 (62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
Total per year (kWh/year) = Sum(64)m =												2561.0168 (64)
2561 (64)												
12Total per year (kWh/year)												
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Ext temp.	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating requirement - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating per m ²	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
	(98c) / (4) =												28.3698 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

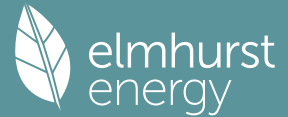
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4089.6796	0.2100	858.8327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3046.8825	0.2100	639.8453	(264)
Space and water heating			1498.6780	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	275.2920	0.1443	39.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582	
PV Unit electricity exported	-1238.1848	0.1257	-155.6511	
Total			-284.1094	(269)
Total CO2, kg/year			1266.2311	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4089.6796	1.1300	4621.3379	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773	(278)
Space and water heating			8064.3152	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	275.2920	1.5338	422.2520	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421	
PV Unit electricity exported	-1238.1848	0.4614	-571.3347	
Total			-2002.4768	(283)
Total Primary energy kWh/year			6614.1912	(286)
Target Primary Energy Rate (TPER)			49.6600	(287)

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Property Reference	77942-04				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 4, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

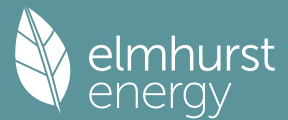
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3276 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12842.7499 (34)

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		W/m2	or Table 6b	or Table 6c	Table 6d	
East	7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (76)
West	9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (80)
West	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768 (86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151 (87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325 (88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735 (89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278 (90)
Living area fraction									FLA = Living area /	(4) =		0.0929 (91)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617 (94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994 (97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98a)
Space heating requirement - total per year (kWh/year)												4183.1031
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031
Space heating per m2										(98c) / (4) =		31.4047 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	221.9620	283.8194	228.5931	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area /	(4) =		1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												183.5936 (107)
Energy for space heating												31.4047 (99)
Energy for space cooling												1.3783 (108)
Total												32.7830 (109)
Fabric Energy Efficiency (DFEE)												32.8 (109)

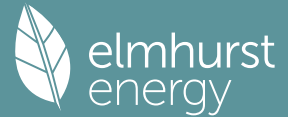
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3776 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3210 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							96.4170 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				13.8300	0.0500	0.6915	
E3 Sill				13.8300	0.0500	0.6915	
E4 Jamb				27.4700	0.0500	1.3735	
E5 Ground floor (normal)				21.5800	0.1600	3.4528	
E16 Corner (normal)				21.1700	0.0900	1.9053	
E18 Party wall between dwellings				14.1100	0.0600	0.8466	
P1 Party wall - Ground floor				8.7000	0.0800	0.6960	
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200	0.5580	
E6 Intermediate floor within a dwelling				21.5800	0.0000	0.0000	
E11 Eaves (insulation at rafter level)				13.5900	0.0400	0.5436	
E13 Gable (insulation at rafter level)				11.5900	0.0800	0.9272	
R5 Ridge (inverted)				5.7100	0.0400	0.2284	
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800	0.4696	
R4 Ridge (vaulted ceiling)				13.1800	0.0800	1.0544	
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900	-0.6354	
R1 Head of roof window				1.1800	0.0800	0.0944	
R2 Sill of roof window				1.1800	0.0600	0.0708	
R3 Jamb of roof window				1.9300	0.0800	0.1544	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1226 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 69.4384 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9028 (42)	
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths												
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510 (42b)	
Hot water usage for other uses												
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449 (42c)	
Average daily hot water use (litres/day)											69.5018 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Energy content (annual)										Total = Sum(45)m =	1154.2766	
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)	
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West				9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West				1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397	664.7359 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (91)
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

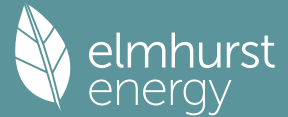
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

8c. Space cooling requirement

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Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

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Property Reference	77942-04				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 4, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

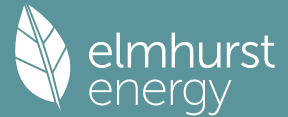
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

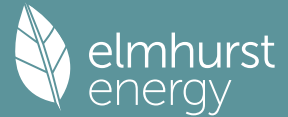
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (76)
West			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (80)
West			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

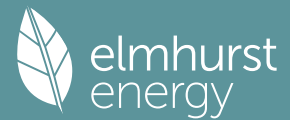
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = $1 - [0.075 \times (19)] = 0.8500$ (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

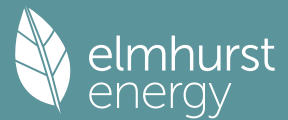
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)												2561.0168	(64)
Electric shower(s)												2561	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (76)			
West				9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (80)			
West				1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²												28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

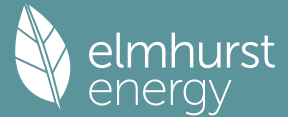
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

Full SAP Calculation Printout



Property Reference	77942-05				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 5, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

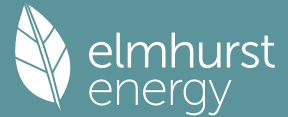
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	4.0000	(17)	
Infiltration rate	0.2000	(18)	
Number of sides sheltered	2	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	13.8300	0.0500	0.6915
E4 Jamb	27.4700	0.0500	1.3735
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.0600	0.2790
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0800	0.0944
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges
Total fabric heat loss

(36a) = 0.0000
(33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(39)
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	31

4. Water heating energy requirements (kWh/year)

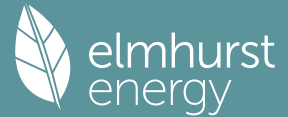
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Distribution loss (46)m = 0.15 x (45)m	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Water storage loss:													Total = Sum(45)m = 2270.6369
Total storage loss	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(59)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(61)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(62)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(63d)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(64a)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

Full SAP Calculation Printout



[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

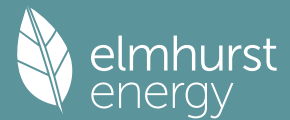
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

Full SAP Calculation Printout



Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor

Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

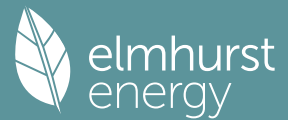
2.9028 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)												136.7047	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total = Sum(45)m =		2270.6369	
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64c)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2561.0168	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)			
West					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)			
East					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²												28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

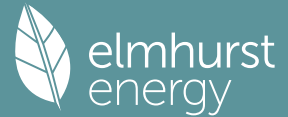
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4089.6796	0.2100	858.8327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3046.8825	0.2100	639.8453	(264)
Space and water heating			1498.6780	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	275.2920	0.1443	39.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582	
PV Unit electricity exported	-1238.1848	0.1257	-155.6511	
Total			-284.1094	(269)
Total CO2, kg/year			1266.2311	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4089.6796	1.1300	4621.3379	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773	(278)
Space and water heating			8064.3152	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	275.2920	1.5338	422.2520	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421	
PV Unit electricity exported	-1238.1848	0.4614	-571.3347	
Total			-2002.4768	(283)
Total Primary energy kWh/year			6614.1912	(286)
Target Primary Energy Rate (TPER)			49.6600	(287)

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Property Reference	77942-05				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 5, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3276 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12842.7499 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588
Heat transfer coeff	126.3652	126.1120	125.8639	124.6983	124.4802	123.4650	123.4650	123.2770	123.8560	124.4802	124.9214	125.3826
Average = Sum(39)m / 12 =												124.6972

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9487	0.9468	0.9449	0.9362	0.9345	0.9269	0.9269	0.9255	0.9299	0.9345	0.9378	0.9413
HLP (average)												0.9362
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596
Energy content (annual)										Total = Sum(45)m =		1154.2766 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (64)
12Total per year (kWh/year)												
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734
												58.3734 (64a)
												663.9941 (64a)
Heat gains from water heating, kWh/month												
40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873	39.7873 (65)

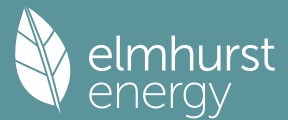
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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				W/m2		or Table 6b		or Table 6c		Table 6d	
East				9.6300		19.6403		0.3300		0.7700	48.0594 (76)
West				7.1300		19.6403		0.3300		0.7700	35.5829 (80)
East				1.1400		25.9287		0.6300		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768 (86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151 (87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325 (88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735 (89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278 (90)
Living area fraction									FLA = Living area / (4) =			0.0929 (91)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617 (94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994 (97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98a)
Space heating requirement - total per year (kWh/year)												4183.1031
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031
Space heating per m2										(98c) / (4) =		31.4047 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	221.9620	283.8194	228.5931	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												183.5936 (107)
Energy for space heating												31.4047 (99)
Energy for space cooling												1.3783 (108)
Total												32.7830 (109)
Fabric Energy Efficiency (DFEE)												32.8 (109)

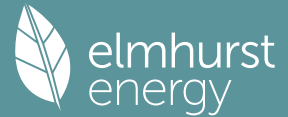
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
													Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3776 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3210 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)	

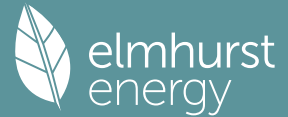
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							96.4170 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				13.8300	0.0500	0.6915	
E3 Sill				13.8300	0.0500	0.6915	
E4 Jamb				27.4700	0.0500	1.3735	
E5 Ground floor (normal)				21.5800	0.1600	3.4528	
E16 Corner (normal)				21.1700	0.0900	1.9053	
E18 Party wall between dwellings				14.1100	0.0600	0.8466	
P1 Party wall - Ground floor				8.7000	0.0800	0.6960	
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200	0.5580	
E6 Intermediate floor within a dwelling				21.5800	0.0000	0.0000	
E11 Eaves (insulation at rafter level)				13.5900	0.0400	0.5436	
E13 Gable (insulation at rafter level)				11.5900	0.0800	0.9272	
R5 Ridge (inverted)				5.7100	0.0400	0.2284	
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800	0.4696	
R4 Ridge (vaulted ceiling)				13.1800	0.0800	1.0544	
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900	-0.6354	
R1 Head of roof window				1.1800	0.0800	0.0944	
R2 Sill of roof window				1.1800	0.0600	0.0708	
R3 Jamb of roof window				1.9300	0.0800	0.1544	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1226 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 69.4384 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9028 (42)	
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths												
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510 (42b)	
Hot water usage for other uses												
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449 (42c)	
Average daily hot water use (litres/day)											69.5018 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy content (annual)											118.5596 (45)	
	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	
Energy content (annual)											Total = Sum(45)m = 1154.2766	
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East					9.6300	19.6403	0.6300	0.7000			0.7700			57.8023 (76)
West					7.1300	19.6403	0.6300	0.7000			0.7700			42.7965 (80)
East					1.1400	25.9287	0.6300	0.7000			1.0000			11.7319 (82)
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561			92.3165 (83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397			664.7359 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction	fLA = Living area / (4) = 0.0929 (91)											
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

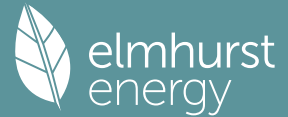
8c. Space cooling requirement

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Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

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Property Reference	77942-05				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 5, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

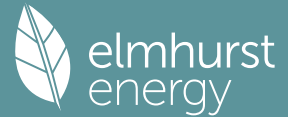
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(38)
Heat transfer coeff	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)
Average = Sum(39)m / 12 =													119.8454

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	(40)
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

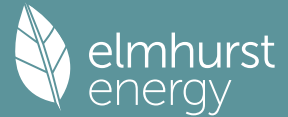
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)													2270.6369
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

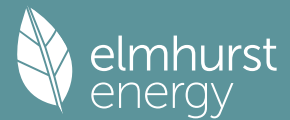
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =	56.3158	(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4384 (37)

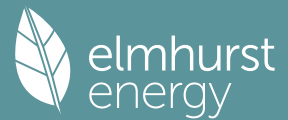
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779 (38)
Heat transfer coeff												
	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164 (39)
Average = Sum(39)m / 12 =												127.6059

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116 (42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)
Average daily hot water use (litres/day)												136.7047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318 (44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517 (45)
Distribution loss (46)m = 0.15 x (45)m												2270.6369
	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106 (62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
Total per year (kWh/year) = Sum(64)m =												2561.0168 (64)
2561 (64)												
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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Heat gains from water heating, kWh/month	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.6300	19.6403		0.6300	0.7000	0.7700		57.8023 (76)	
West					7.1300	19.6403		0.6300	0.7000	0.7700		42.7965 (80)	
East					1.1400	25.9287		0.6300	0.7000	1.0000		11.7319 (82)	
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689 (86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646 (89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424 (90)
Living area fraction	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665 (91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Ext temp.	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating requirement - total per year (kWh/year)	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Solar heating kWh												3778.8639	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²												28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												92.4000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	80.3000 (216)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	86.5599 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4089.6796 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												3046.8825 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												275.2920 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2194.5813 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5303.2728 (238)

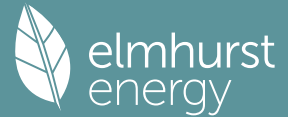
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-06				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 6, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

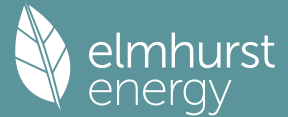
2. Ventilation rate

											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1700 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

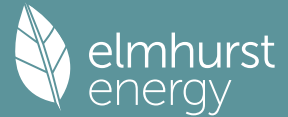
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction									FLA = Living area / (4) =			0.0929 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9428	0.9184	0.8790	0.7989	0.6807	0.5207	0.3734	0.4182	0.6380	0.8355	0.9188	0.9485 (94)
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													88.6000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068	(98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000	(210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151	(216)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308	(217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147	(221)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(222)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													3902.9779 (211)

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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.7000	
Water heating fuel used	2425.9173	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	58.9956	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	144.9956	(231)
Electricity for lighting (calculated in Appendix L)	275.2920	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1637.8174	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5111.3653	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

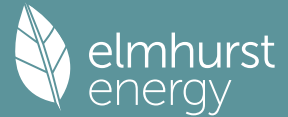
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4384 (37)

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

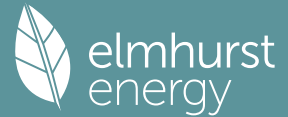
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total =	Sum(45)m =	2270.6369	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)								Total per year (kWh/year) =	Sum(64)m =			2561.0168	(64)
												2561	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)			
West				7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)			
East				1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165 (83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

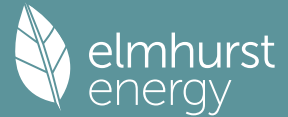
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-06				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 6, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3276 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12842.7499 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588
Heat transfer coeff	126.3652	126.1120	125.8639	124.6983	124.4802	123.4650	123.4650	123.2770	123.8560	124.4802	124.9214	125.3826
Average = Sum(39)m / 12 =												124.6972

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9487	0.9468	0.9449	0.9362	0.9345	0.9269	0.9269	0.9255	0.9299	0.9345	0.9378	0.9413
HLP (average)												0.9362
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596
Energy content (annual)										Total = Sum(45)m =		1154.2766 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (64)
12Total per year (kWh/year)												
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734
												58.3734 (64a)
												663.9941 (64a)
Heat gains from water heating, kWh/month												
40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873	39.7873 (65)

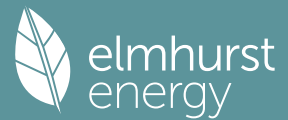
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	
East	9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (76)
West	7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (80)
East	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768 (86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151 (87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325 (88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735 (89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278 (90)
Living area fraction	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (92)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)
Temperature adjustment												0.0000
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617 (94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994 (97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98a)
Space heating requirement - total per year (kWh/year)												4183.1031
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031
Space heating per m2										(98c) / (4) =		31.4047 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	221.9620	283.8194	228.5931	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												183.5936 (107)
Energy for space heating												31.4047 (99)
Energy for space cooling												1.3783 (108)
Total												32.7830 (109)
Fabric Energy Efficiency (DFEE)												32.8 (109)

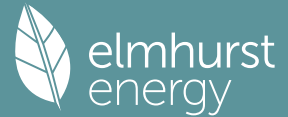
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.3776 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3210 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)	

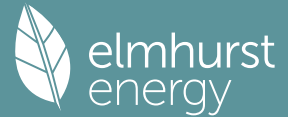
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								96.4170 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				13.8300	0.0500		0.6915	
E3 Sill				13.8300	0.0500		0.6915	
E4 Jamb				27.4700	0.0500		1.3735	
E5 Ground floor (normal)				21.5800	0.1600		3.4528	
E16 Corner (normal)				21.1700	0.0900		1.9053	
E18 Party wall between dwellings				14.1100	0.0600		0.8466	
P1 Party wall - Ground floor				8.7000	0.0800		0.6960	
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200		0.5580	
E6 Intermediate floor within a dwelling				21.5800	0.0000		0.0000	
E11 Eaves (insulation at rafter level)				13.5900	0.0400		0.5436	
E13 Gable (insulation at rafter level)				11.5900	0.0800		0.9272	
R5 Ridge (inverted)				5.7100	0.0400		0.2284	
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800		0.4696	
R4 Ridge (vaulted ceiling)				13.1800	0.0800		1.0544	
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900		-0.6354	
R1 Head of roof window				1.1800	0.0800		0.0944	
R2 Sill of roof window				1.1800	0.0600		0.0708	
R3 Jamb of roof window				1.9300	0.0800		0.1544	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								13.1226 (36)
Point Thermal bridges								(36a) = 0.0000
Total fabric heat loss								(33) + (36) + (36a) = 69.4384 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9028 (42)	
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)	
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)	
Average daily hot water use (litres/day)											69.5018 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)	
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Energy content (annual)										Total = Sum(45)m =		1154.2766
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
East				9.6300	19.6403	0.6300	0.7000		0.7700		57.8023	(76)	
West				7.1300	19.6403	0.6300	0.7000		0.7700		42.7965	(80)	
East				1.1400	25.9287	0.6300	0.7000		1.0000		11.7319	(82)	
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397	664.7359	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction	fLA = Living area / (4) = 0.0929 (91)											
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

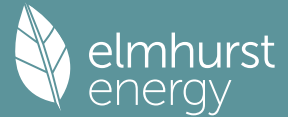
8c. Space cooling requirement

Full SAP Calculation Printout



Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

Full SAP Calculation Printout



Property Reference	77942-06				Issued on Date	18/12/2024
Assessment Reference	001		Prop Type Ref	NDS-33 (Semi)		
Property	Plot 6, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

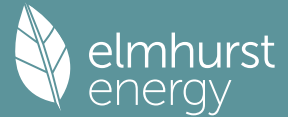
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

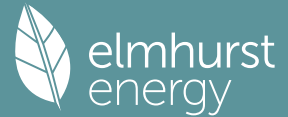
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

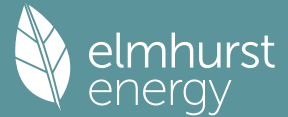
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

Infiltration rate adjusted to include shelter factor

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
P1 Party wall between dwellings	8.7000	0.0800	0.6960
P4 Party wall - Ground floor	4.6500	0.1200	0.5580
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0600	0.0708
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

13.1226 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

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

(38)m	Jan 60.3834	Feb 60.0470	Mar 59.7173	Apr 58.1688	May 57.8791	Jun 56.5303	Jul 56.5303	Aug 56.2806	Sep 57.0499	Oct 57.8791	Nov 58.4652	Dec 59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

HLP	Jan 0.9746	Feb 0.9721	Mar 0.9696	Apr 0.9580	May 0.9558	Jun 0.9457	Jul 0.9457	Aug 0.9438	Sep 0.9496	Oct 0.9558	Nov 0.9602	Dec 0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

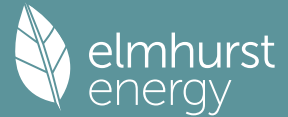
2.9028 (42)

Hot water usage for mixer showers

Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)												136.7047	(43)

Daily hot water use	Jan 148.7174	Feb 145.5417	Mar 141.6743	Apr 135.7937	May 131.0182	Jun 125.8842	Jul 123.9113	Aug 127.7620	Sep 131.8231	Oct 137.2129	Nov 143.1841	Dec 148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total = Sum(45)m =		2270.6369	
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64c)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2561.0168	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				9.6300	19.6403		0.6300		0.7000		0.7700		57.8023 (76)
West				7.1300	19.6403		0.6300		0.7000		0.7700		42.7965 (80)
East				1.1400	25.9287		0.6300		0.7000		1.0000		11.7319 (82)
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561		92.3165 (83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829		735.1770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	80.3000 (216)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	86.5599 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4089.6796 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												3046.8825 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												275.2920 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2194.5813 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5303.2728 (238)

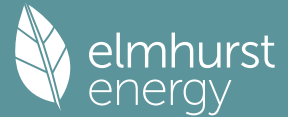
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

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Property Reference	77942-07				Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)			
Property	Plot 7, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

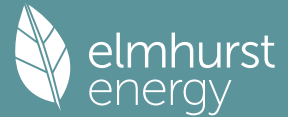
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

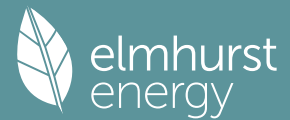
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor

Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
P1 Party wall between dwellings	8.7000	0.0800	0.6960
P4 Party wall - Ground floor	4.6500	0.1200	0.5580
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0600	0.0708
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 69.4384 (37)

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

(38)m	Jan 60.3834	Feb 60.0470	Mar 59.7173	Apr 58.1688	May 57.8791	Jun 56.5303	Jul 56.5303	Aug 56.2806	Sep 57.0499	Oct 57.8791	Nov 58.4652	Dec 59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

HLP	Jan 0.9746	Feb 0.9721	Mar 0.9696	Apr 0.9580	May 0.9558	Jun 0.9457	Jul 0.9457	Aug 0.9438	Sep 0.9496	Oct 0.9558	Nov 0.9602	Dec 0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

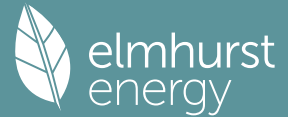
2.9028 (42)

Hot water usage for mixer showers

Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)												136.7047	(43)

Daily hot water use	Jan 148.7174	Feb 145.5417	Mar 141.6743	Apr 135.7937	May 131.0182	Jun 125.8842	Jul 123.9113	Aug 127.7620	Sep 131.8231	Oct 137.2129	Nov 143.1841	Dec 148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total = Sum(45)m = 2270.6369			
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64c)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m = 2561.0168		2561	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.6300	19.6403		0.6300	0.7000	0.7700		57.8023 (76)	
West					7.1300	19.6403		0.6300	0.7000	0.7700		42.7965 (80)	
East					1.1400	25.9287		0.6300	0.7000	1.0000		11.7319 (82)	
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

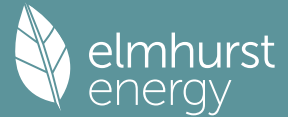
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4089.6796	0.2100	858.8327 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3046.8825	0.2100	639.8453 (264)
Space and water heating			1498.6780 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582
PV Unit electricity exported	-1238.1848	0.1257	-155.6511
Total			-284.1094 (269)
Total CO2, kg/year			1266.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4089.6796	1.1300	4621.3379 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773 (278)
Space and water heating			8064.3152 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421
PV Unit electricity exported	-1238.1848	0.4614	-571.3347
Total			-2002.4768 (283)
Total Primary energy kWh/year			6614.1912 (286)
Target Primary Energy Rate (TPER)			49.6600 (287)

Full SAP Calculation Printout



Property Reference	77942-07				Issued on Date	18/12/2024		
Assessment Reference	001			Prop Type Ref	NDS-33 (Semi)			
Property	Plot 7, Chapel Street, MANCHESTER, M19 3QB							
SAP Rating	93 A		DER	8.86		TER	9.51	
Environmental	91 B		% DER < TER				6.83	
CO ₂ Emissions (t/year)	1.13		DFEE	32.78		TFEE	33.33	
Compliance Check	See BREL		% DFEE < TFEE				1.64	
% DPER < TPER	5.63		DPER	46.86		TPER	49.66	
Assessor Details	Mr. Paul Goddard					Assessor ID	B342-0001	
Client								

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

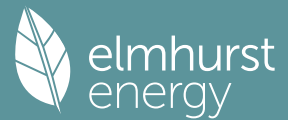
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3276 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2785 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12842.7499 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588
Heat transfer coeff	126.3652	126.1120	125.8639	124.6983	124.4802	123.4650	123.4650	123.2770	123.8560	124.4802	124.9214	125.3826
Average = Sum(39)m / 12 =												124.6972

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9487	0.9468	0.9449	0.9362	0.9345	0.9269	0.9269	0.9255	0.9299	0.9345	0.9378	0.9413
HLP (average)												0.9362
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Energy content (annual)										Total = Sum(45)m =		1154.2766
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (64)
12Total per year (kWh/year)												
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												663.9941 (64a)
Heat gains from water heating, kWh/month												
40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873	39.7873 (65)

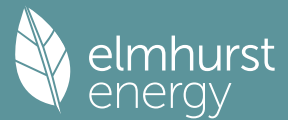
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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				W/m2		or Table 6b		or Table 6c		Table 6d	
East				9.6300		19.6403		0.3300		0.7700	48.0594 (76)
West				7.1300		19.6403		0.3300		0.7700	35.5829 (80)
East				1.1400		25.9287		0.6300		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	681.5356	792.6161	887.4031	1016.1988	1091.1822	1088.1711	1040.3165	960.7518	870.5268	746.4973	673.5969	650.7917 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.2311	28.2878	28.3436	28.6085	28.6586	28.8943	28.8943	28.9383	28.8030	28.6586	28.5574	28.4524
alpha	2.8821	2.8859	2.8896	2.9072	2.9106	2.9263	2.9263	2.9292	2.9202	2.9106	2.9038	2.8968
util living area	0.9736	0.9586	0.9319	0.8685	0.7659	0.6172	0.4818	0.5312	0.7380	0.9035	0.9599	0.9768 (86)
MIT	18.5626	18.8577	19.3161	19.9397	20.4546	20.7985	20.9286	20.9035	20.6400	19.9496	19.1562	18.5151 (87)
Th 2	20.1263	20.1279	20.1295	20.1369	20.1382	20.1447	20.1447	20.1459	20.1422	20.1382	20.1354	20.1325 (88)
util rest of house	0.9699	0.9528	0.9221	0.8490	0.7299	0.5574	0.4007	0.4497	0.6862	0.8851	0.9533	0.9735 (89)
MIT 2	17.8706	18.1634	18.6158	19.2253	19.7082	20.0121	20.1093	20.0954	19.8860	19.2462	18.4670	17.8278 (90)
Living area fraction									FLA = Living area /	(4) =		0.0929 (91)
MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9349	18.2279	18.6809	19.2917	19.7775	20.0852	20.1855	20.1705	19.9560	19.3116	18.5310	17.8917 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9571	0.9362	0.9015	0.8264	0.7131	0.5529	0.4047	0.4522	0.6736	0.8631	0.9370	0.9617 (94)
Useful gains	652.2945	742.0331	799.9906	839.7899	778.1297	601.6392	421.0559	434.4592	586.3541	644.3137	631.1896	625.8915 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1722.9822	1680.8087	1533.1355	1295.8258	1005.4936	677.2241	442.6792	464.8130	725.3048	1084.4224	1427.9784	1716.6994 (97)
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98a)
Space heating requirement - total per year (kWh/year)												4183.1031
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	796.5916	630.8572	545.4598	328.3458	169.1588	0.0000	0.0000	0.0000	0.0000	327.4409	573.6879	811.5611 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4183.1031
Space heating per m2										(98c) / (4) =		31.4047 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1160.5709	913.6409	936.9051	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8180	0.7834	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3514	747.3835	733.9853	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.6320	1128.8613	1041.2342	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	221.9620	283.8194	228.5931	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	55.4905	70.9549	57.1483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												183.5936 (107)
Energy for space heating												31.4047 (99)
Energy for space cooling												1.3783 (108)
Total												32.7830 (109)
Fabric Energy Efficiency (DFEE)												32.8 (109)

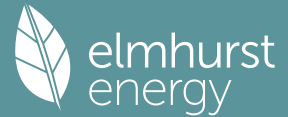
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

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											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.3776 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3210 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)	

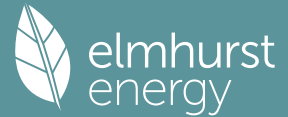
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	56.3158		(33)
Party Wall			43.4800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							96.4170 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				13.8300	0.0500		0.6915
E3 Sill				13.8300	0.0500		0.6915
E4 Jamb				27.4700	0.0500		1.3735
E5 Ground floor (normal)				21.5800	0.1600		3.4528
E16 Corner (normal)				21.1700	0.0900		1.9053
E18 Party wall between dwellings				14.1100	0.0600		0.8466
P1 Party wall - Ground floor				8.7000	0.0800		0.6960
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200		0.5580
E6 Intermediate floor within a dwelling				21.5800	0.0000		0.0000
E11 Eaves (insulation at rafter level)				13.5900	0.0400		0.5436
E13 Gable (insulation at rafter level)				11.5900	0.0800		0.9272
R5 Ridge (inverted)				5.7100	0.0400		0.2284
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800		0.4696
R4 Ridge (vaulted ceiling)				13.1800	0.0800		1.0544
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900		-0.6354
R1 Head of roof window				1.1800	0.0800		0.0944
R2 Sill of roof window				1.1800	0.0600		0.0708
R3 Jamb of roof window				1.9300	0.0800		0.1544
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1226 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =						69.4384 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9028 (42)	
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)	
Hot water usage for baths												
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510 (42b)	
Hot water usage for other uses												
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449 (42c)	
Average daily hot water use (litres/day)											69.5018 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy content (annual)											118.5596 (45)	
	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	
Energy content (annual)											Total = Sum(45)m = 1154.2766	
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	(72)
Total internal gains	586.1614	605.5217	577.9511	562.7314	533.4937	516.4067	496.3319	494.7877	509.9268	524.1465	554.5836	572.4195	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
East				9.6300	19.6403	0.6300	0.7000		0.7700		57.8023	(76)	
West				7.1300	19.6403	0.6300	0.7000		0.7700		42.7965	(80)	
East				1.1400	25.9287	0.6300	0.7000		1.0000		11.7319	(82)	
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	698.4922	825.7867	942.0305	1095.8695	1188.8216	1188.1225	1135.4743	1042.4910	934.0607	785.8571	694.7397	664.7359	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506
util living area	0.9722	0.9551	0.9240	0.8519	0.7400	0.5871	0.4546	0.5047	0.7166	0.8950	0.9574	0.9757 (86)
MIT	18.5161	18.8358	19.3248	19.9751	20.4886	20.8168	20.9357	20.9120	20.6574	19.9570	19.1335	18.4707 (87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127 (88)
util rest of house	0.9683	0.9488	0.9132	0.8306	0.7020	0.5269	0.3752	0.4242	0.6628	0.8752	0.9504	0.9722 (89)
MIT 2	17.8100	18.1270	18.6088	19.2432	19.7213	20.0100	20.0976	20.0851	19.8846	19.2393	18.4315	17.7705 (90)
Living area fraction	fLA = Living area / (4) = 0.0929 (91)											
MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8756	18.1929	18.6754	19.3112	19.7926	20.0850	20.1755	20.1620	19.9564	19.3060	18.4968	17.8356 (93)

8. Space heating requirement

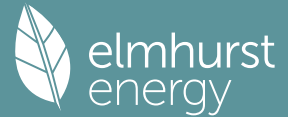
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.9151	768.9039	839.6567	885.1427	815.9303	622.1542	431.0594	445.4011	608.2619	669.9139	648.3980	638.0682	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1762.4064	1721.2333	1572.5215	1328.5482	1030.3284	690.9342	450.4011	472.9553	740.7687	1108.4264	1457.6902	1752.3985	(97)
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98a)
Space heating requirement - total per year (kWh/year)												4217.0319	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	815.0455	639.9653	545.2514	319.2519	159.5123	0.0000	0.0000	0.0000	0.0000	326.2533	582.6904	829.0618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.0319	
Space heating per m2												(98c) / (4) =	31.6594 (99)

8c. Space cooling requirement

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Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1184.1066	932.1691	955.4646	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7757	0.8376	0.8036	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.5226	780.7471	767.8491	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1297.4583	1240.0847	1136.7734	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.8337	341.7472	274.4797	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2084	85.4368	68.6199	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2651 (107)
Energy for space heating												31.6594 (99)
Energy for space cooling												1.6687 (108)
Total												33.3281 (109)
Fabric Energy Efficiency (TFEE)												33.3 (109)

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Property Reference	77942-07				Issued on Date	18/12/2024
Assessment Reference	001		Prop Type Ref	NDS-33 (Semi)		
Property	Plot 7, Chapel Street, MANCHESTER, M19 3QB					
SAP Rating	93 A	DER	8.86	TER	9.51	
Environmental	91 B	% DER < TER				6.83
CO ₂ Emissions (t/year)	1.13	DFEE	32.78	TFEE	33.33	
Compliance Check	See BREL	% DFEE < TFEE				1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66	
Assessor Details	Mr. Paul Goddard				Assessor ID	B342-0001
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.4640 (5)

2. Ventilation rate

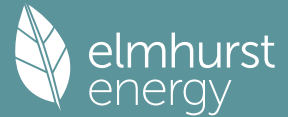
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			16.7600	1.1450	19.1908		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	18.9100	114.6300	0.1700	19.4871	9.0000	1031.6699 (29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2566		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12842.7499 (34)
96.4170 (35)

	Length	Psi-value	Total
K1 Element	13.8300	0.0500	0.6915
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915
E3 Sill	27.4700	0.0500	1.3735
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.9300	0.0800	0.1544
R3 Jamb of roof window			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.1238 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	
Average = Sum(39)m / 12 =	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	119.8454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	0.8997	
HLP (average)													0.8997
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

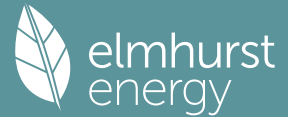
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	641.0415	659.0538	628.3492	605.5473	571.8505	547.0500	523.7465	524.3472	542.0769	564.5515	602.2239	626.2671	(73)

6. Solar gains

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[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East			9.6300	19.6403	0.3300		0.0000		0.7700	48.0594 (76)
West			7.1300	19.6403	0.3300		0.0000		0.7700	35.5829 (80)
East			1.1400	25.9287	0.6300		0.7000		1.0000	11.7319 (82)

Solar gains	95.3742	187.0944	309.4520	453.4674	557.6884	571.7644	543.9845	465.9642	360.6000	222.3508	119.0132	78.3722 (83)
Total gains	736.4156	846.1482	937.8012	1059.0146	1129.5389	1118.8144	1067.7311	990.3113	902.6769	786.9023	721.2371	704.6393 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669	29.7669
alpha	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845	2.9845
util living area	0.9674	0.9502	0.9201	0.8522	0.7440	0.5957	0.4615	0.5091	0.7153	0.8888	0.9517	0.9712 (86)
MIT	18.7870	19.0677	19.4980	20.0598	20.5293	20.8275	20.9406	20.9191	20.6889	20.0609	19.3184	18.7183 (87)
Th 2	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677	20.1677 (88)
util rest of house	0.9630	0.9436	0.9092	0.8316	0.7076	0.5374	0.3844	0.4311	0.6633	0.8687	0.9441	0.9674 (89)
MIT 2	17.5407	17.8957	18.4377	19.1330	19.6929	20.0223	20.1300	20.1134	19.8848	19.1476	18.2177	17.4536 (90)
Living area fraction	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	0.9299 (91)
MIT	17.6565	18.0046	18.5362	19.2191	19.7706	20.0971	20.2053	20.1883	19.9595	19.2325	18.3200	17.5711 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5065	17.8546	18.3862	19.0691	19.6206	19.9471	20.0553	20.0383	19.8095	19.0825	18.1700	17.4211 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	694.2797	777.0823	824.3302	846.0992	768.8608	582.6160	398.7414	414.0997	575.8968	657.4579	662.6885	668.3535 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1582.7437	1552.5481	1424.5073	1218.7194	949.2504	640.8295	414.1014	436.0332	684.2590	1016.5881	1326.6890	1584.4916 (97)
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98a)
Space heating requirement - total per year (kWh/year)												3458.0384
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.0384
Space heating per m2										(98c) / (4) =		25.9612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 88.6000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	661.0172	521.1130	446.5318	268.2865	134.2099	0.0000	0.0000	0.0000	0.0000	267.1928	478.0804	681.6068 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	746.0691	588.1637	503.9862	302.8065	151.4784	0.0000	0.0000	0.0000	0.0000	301.5720	539.5941	769.3079 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5488	86.3781	86.0370	85.3873	84.1297	80.7000	80.7000	80.7000	80.7000	85.3701	86.2575	86.6151 (217)
Fuel for water heating, kWh/month	243.9620	215.0309	227.0139	196.1468	189.3942	173.8948	169.0133	178.1886	182.7993	197.1592	212.7834	240.5308 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.3147	-43.3560	-70.6217	-87.9494	-100.5908	-95.8023	-94.1506	-85.6401	-71.0648	-52.7687	-31.3809	-22.8868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7239	-23.5769	-55.6298	-96.8102	-139.5341	-144.7401	-141.3573	-112.5205	-73.1563	-36.2594	-13.5959	-7.3862 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3902.9779 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.7000
Water heating fuel used	2425.9173 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	58.9956 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	144.9956 (231)
Electricity for lighting (calculated in Appendix L)	275.2920 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1637.8174 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5111.3653 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3902.9779	0.2100	819.6254 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9173	0.2100	509.4426 (264)
Space and water heating			1329.0680 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	275.2920	0.1443	39.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	0.1326	-103.9033
PV Unit electricity exported	-854.2906	0.1224	-104.5481
Total			-208.4514 (269)
Total CO2, kg/year			1180.4624 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3902.9779	1.1300	4410.3650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9173	1.1300	2741.2865 (278)
Space and water heating			7151.6516 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	275.2920	1.5338	422.2520 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-783.5268	1.4900	-1167.4520
PV Unit electricity exported	-854.2906	0.4490	-383.6172
Total			-1551.0692 (283)
Total Primary energy kWh/year			6242.1837 (286)
Dwelling Primary energy Rate (DPER)			46.8600 (287)

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

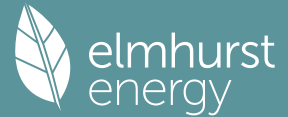
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3776 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.3210 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771	(22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			16.7600	1.1450	19.1908			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	18.9100	114.6300	0.1800	20.6334			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 56.3158			(33)
Party Wall			43.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.4170 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	13.8300	0.0500	0.6915	
E2 Other lintels (including other steel lintels)	13.8300	0.0500	0.6915	
E3 Sill	27.4700	0.0500	1.3735	
E4 Jamb	21.5800	0.1600	3.4528	
E5 Ground floor (normal)	21.1700	0.0900	1.9053	
E16 Corner (normal)	14.1100	0.0600	0.8466	
P1 Party wall between dwellings	8.7000	0.0800	0.6960	
P4 Party wall - Ground floor	4.6500	0.1200	0.5580	
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436	
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272	
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284	
R5 Ridge (inverted)	5.8700	0.0800	0.4696	
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544	
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354	
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944	
R1 Head of roof window	1.1800	0.0600	0.0708	
R2 Sill of roof window	1.9300	0.0800	0.1544	
R3 Jamb of roof window				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 69.4384 (37)

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

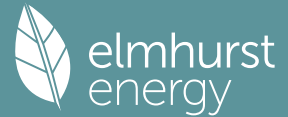
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779	(38)
Heat transfer coeff	129.8218	129.4855	129.1558	127.6072	127.3175	125.9688	125.9688	125.7190	126.4883	127.3175	127.9036	128.5164	(39)
Average = Sum(39)m / 12 =												127.6059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9746	0.9721	0.9696	0.9580	0.9558	0.9457	0.9457	0.9438	0.9496	0.9558	0.9602	0.9648	(40)
HLP (average)												0.9580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)	
Hot water usage for baths													
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)	
Hot water usage for other uses													
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)	
Average daily hot water use (litres/day)												136.7047	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)	
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)	
12Total per year (kWh/year)												2561.0168	(64)
Electric shower(s)												2561	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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Heat gains from water heating, kWh/month
91.0541 80.4173 85.1410 74.1388 71.3846 63.7962 62.5682 65.3399 66.3770 74.6501 80.1561 89.9634 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.1666	181.7559	164.1666	169.6389	164.1666	169.6389	164.1666	164.1666	169.6389	164.1666	169.6389	164.1666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186	(72)
Total internal gains	657.6312	675.6334	644.9274	622.1471	588.4618	563.6775	540.3918	540.9882	558.7133	581.1732	618.8268	642.8605	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East					9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)			
West					7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)			
East					1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	112.3308	220.2650	364.0793	533.1381	655.3279	671.7158	639.1423	547.7033	424.1339	261.7105	140.1561	92.3165	(83)
Total gains	769.9619	895.8985	1009.0067	1155.2852	1243.7897	1235.3932	1179.5341	1088.6915	982.8472	842.8837	758.9829	735.1770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	27.4794	27.5508	27.6211	27.9563	28.0200	28.3200	28.3200	28.3762	28.2036	28.0200	27.8916	27.7586	
alpha	2.8320	2.8367	2.8414	2.8638	2.8680	2.8880	2.8880	2.8917	2.8802	2.8680	2.8594	2.8506	
util living area	0.9650	0.9459	0.9123	0.8372	0.7230	0.5710	0.4402	0.4875	0.6967	0.8795	0.9478	0.9689	(86)
MIT	18.6227	18.9340	19.4084	20.0316	20.5214	20.8299	20.9409	20.9197	20.6834	20.0208	19.2245	18.5775	(87)
Th 2	20.1045	20.1066	20.1087	20.1185	20.1203	20.1288	20.1288	20.1304	20.1255	20.1203	20.1166	20.1127	(88)
util rest of house	0.9601	0.9386	0.9002	0.8146	0.6841	0.5111	0.3625	0.4085	0.6420	0.8576	0.9395	0.9646	(89)
MIT 2	17.2949	17.6894	18.2870	19.0619	19.6436	19.9880	20.0922	20.0778	19.8421	19.0655	18.0680	17.2424	(90)
Living area fraction									FLA = Living area / (4) =			0.0929	(91)
MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4183	17.8050	18.3912	19.1520	19.7251	20.0663	20.1711	20.1560	19.9203	19.1543	18.1754	17.3665	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9392	0.9129	0.8702	0.7853	0.6648	0.5065	0.3664	0.4109	0.6277	0.8276	0.9144	0.9453	(94)
Useful gains	723.1804	817.8529	878.0146	907.2705	826.9088	625.7598	432.2335	447.3588	616.9598	697.5990	693.9772	694.9309	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.0374	1671.0155	1535.8233	1308.2302	1021.7421	688.5796	449.8449	472.2048	736.1943	1089.1102	1416.5894	1692.1129	(97)
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98a)
Space heating requirement - total per year (kWh/year)												3778.8639	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3778.8639	
Space heating per m ²										(98c) / (4) =		28.3698	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	729.0136	573.3252	489.4096	288.6910	144.9559	0.0000	0.0000	0.0000	0.0000	291.2844	520.2808	741.9034	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	788.9758	620.4819	529.6641	312.4361	156.8787	0.0000	0.0000	0.0000	0.0000	315.2428	563.0744	802.9257	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5118	86.3049	85.8915	85.0672	83.6668	80.3000	80.3000	80.3000	80.3000	85.0595	86.1144	86.5599	(217)
Fuel for water heating, kWh/month	292.6403	259.3202	276.9153	246.4599	243.2504	228.7993	226.2980	235.1710	237.5862	249.5891	261.4522	289.4007	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	34.1106	27.3648	24.6389	18.0515	13.9435	11.3920	12.7198	16.5336	21.4755	28.1771	31.8259	35.0586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.2050	-61.7826	-90.0283	-102.6091	-111.7480	-104.6190	-103.2657	-96.9278	-85.9560	-71.2235	-47.7849	-37.2467	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8054	-46.1558	-92.2955	-139.4610	-185.2590	-186.5265	-184.3970	-155.7873	-113.6924	-66.3577	-29.2205	-17.2268	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4089.6796	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3046.8825	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.2920	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5303.2728	(238)

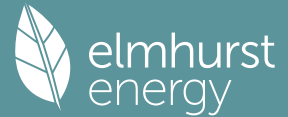
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4089.6796	0.2100	858.8327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3046.8825	0.2100	639.8453	(264)
Space and water heating			1498.6780	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	275.2920	0.1443	39.7331	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	0.1343	-128.4582	
PV Unit electricity exported	-1238.1848	0.1257	-155.6511	
Total			-284.1094	(269)
Total CO2, kg/year			1266.2311	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4089.6796	1.1300	4621.3379	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3046.8825	1.1300	3442.9773	(278)
Space and water heating			8064.3152	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	275.2920	1.5338	422.2520	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-956.3965	1.4964	-1431.1421	
PV Unit electricity exported	-1238.1848	0.4614	-571.3347	
Total			-2002.4768	(283)
Total Primary energy kWh/year			6614.1912	(286)
Target Primary Energy Rate (TPER)			49.6600	(287)

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Property Reference	77942-08			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 8, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.13	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

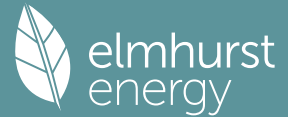
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

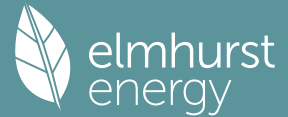
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Door			2.1500	1.2000	2.5800		(26)
Velux			1.1400	1.5038	1.7143		(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000 (28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199 (29a)
PIU	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600 (30)
Total net area of external elements Aum(A, m ²)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0831		(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999 (32)
Timber			81.2800			9.0000	731.5200 (32c)
FF			44.4000			18.0000	799.2000 (32d)
Internal Floor 2			44.4000			18.0000	799.2000 (32d)
GF			44.4000			9.0000	399.6000 (32e)
Internal Ceiling 2			44.4000			9.0000	399.6000 (32e)

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Heat capacity Cm = Sum(A x k)												
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
List of Thermal Bridges												
(28)...(30) + (32) + (32a)...(32e) = 12798.1999 (34)												
96.0826 (35)												
K1 Element												
E2 Other lintels (including other steel lintels)												
E3 Sill												
E4 Jamb												
E5 Ground floor (normal)												
E16 Corner (normal)												
E18 Party wall between dwellings												
P1 Party wall - Ground floor												
P4 Party wall - Roof (insulation at ceiling level)												
E6 Intermediate floor within a dwelling												
E11 Eaves (insulation at rafter level)												
E13 Gable (insulation at rafter level)												
R5 Ridge (inverted)												
P5 Party wall - Roof (insulation at rafter level)												
R4 Ridge (vaulted ceiling)												
E17 Corner (inverted - internal area greater than external area)												
R1 Head of roof window												
R2 Sill of roof window												
R3 Jamb of roof window												
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												
Point Thermal bridges												
Total fabric heat loss												
(33) + (36) + (36a) = 73.8433 (37)												
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216
Average = Sum(39)m / 12 =	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648
HLP	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427
HLP (average)	31	28	31	30	31	30	31	31	30	31	30	31
Days in mont												
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251
Total internal gains	633.2020	650.3745	620.5097	597.4465	564.0111	538.9493	515.9071	516.5077	533.9762	556.7121	594.1231	618.4277
6. Solar gains												

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b		Specific data or Table 6c		FF	Access factor Table 6d	Gains W
East	9.6300				19.6403	0.3300		0.0000			0.7700	48.0594 (76)
South	4.9500				46.7521	0.3300		0.0000			0.7700	58.8045 (78)
West	7.1300				19.6403	0.3300		0.0000			0.7700	35.5829 (80)
East	1.1400				25.9287	0.6300		0.7000			1.0000	11.7319 (82)
Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847 (83)
Total gains	787.3807	933.7755	1052.6393	1189.5662	1266.1838	1249.7601	1195.7485	1114.4077	1022.7274	882.9386	782.8398	747.6124 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125
alpha	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875
util living area	0.9622	0.9391	0.9016	0.8255	0.7120	0.5648	0.4339	0.4777	0.6784	0.8662	0.9430	0.9671 (86)
MIT	18.7334	19.0628	19.5249	20.0906	20.5494	20.8346	20.9431	20.9235	20.7079	20.0842	19.2956	18.6536 (87)
Th 2	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314 (88)
util rest of house	0.9572	0.9312	0.8886	0.8022	0.6731	0.5053	0.3572	0.3998	0.6234	0.8429	0.9342	0.9627 (89)
MIT 2	17.4511	17.8663	18.4456	19.1411	19.6831	19.9946	20.0961	20.0813	19.8712	19.1485	18.1661	17.3501 (90)
Living area fraction	fLA = Living area / (4) = 0.0929 (91)											
MIT	17.5703	17.9775	18.5459	19.2293	19.7636	20.0726	20.1748	20.1596	19.9490	19.2354	18.2711	17.4712 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.4203	17.8275	18.3959	19.0793	19.6136	19.9226	20.0248	20.0096	19.7990	19.0854	18.1211	17.3212 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.9026	0.8554	0.7688	0.6473	0.4900	0.3474	0.3882	0.5999	0.8079	0.9059	0.9415 (94)
Useful gains	735.6862	842.8314	900.4432	914.5502	819.6015	612.4077	415.3892	432.5978	613.4854	713.3261	709.1754	703.8837 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1647.4473	1623.2443	1493.7054	1278.1661	993.6751	668.3363	430.0351	453.2400	715.5902	1065.4716	1383.8615	1647.5657 (97)
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98a)
Space heating requirement - total per year (kWh/year)												3485.3586
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3485.3586
Space heating per m2	(98c) / (4) =											26.1664 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.6000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	765.6323	591.9159	498.1795	295.4893	146.1747	0.0000	0.0000	0.0000	0.0000	295.7068	548.2776	792.4373 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5879	86.3882	86.0169	85.3406	84.0607	80.7000	80.7000	80.7000	80.7000	85.3326	86.2837	86.6588 (217)
Fuel for water heating, kWh/month	243.8519	215.0056	227.0670	196.2542	189.5497	173.8948	169.0133	178.1886	182.7993	197.2460	212.7187	240.4095 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.2974	-43.3211	-70.5575	-87.8669	-100.5010	-95.7200	-94.0595	-85.5415	-70.9764	-52.7117	-31.3558	-22.8726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-9.7413	-23.6118	-55.6940	-96.8927	-139.6238	-144.8224	-141.4485	-112.6191	-73.2446	-36.3165	-13.6210	-7.4004 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	3933.8133	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.7000	
Water heating fuel used	2425.9987	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	58.9956	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	144.9956	(231)
Electricity for lighting (calculated in Appendix L)	262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1637.8174	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5129.1362	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3933.8133	0.2100	826.1008 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9987	0.2100	509.4597 (264)
Space and water heating			1335.5605 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	0.1326	-103.8058
PV Unit electricity exported	-855.0362	0.1224	-104.6445
Total			-208.4502 (269)
Total CO2, kg/year			1185.0588 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.9000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3933.8133	1.1300	4445.2091 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9987	1.1300	2741.3786 (278)
Space and water heating			7186.5877 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	1.4900	-1166.3460
PV Unit electricity exported	-855.0362	0.4491	-383.9712
Total			-1550.3172 (283)
Total Primary energy kWh/year			6257.7080 (286)
Dwelling Primary energy Rate (DPER)			46.9800 (287)

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

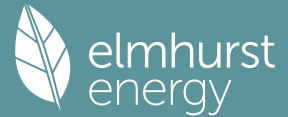
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)

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Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3776 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3210 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)
	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0928		(33)
Party Wall			43.4800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.0826 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	17.9200	0.0500	0.8960
E4 Jamb	37.1500	0.0500	1.8575
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.1200	0.5580
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0600	0.0708
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0156 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.1084 (37)

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

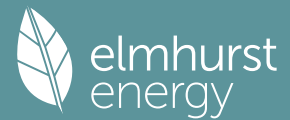
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779 (38)
Average = Sum(39)m / 12 =	135.4918	135.1554	134.8257	133.2772	132.9875	131.6387	131.6387	131.3890	132.1582	132.9875	133.5736	134.1863 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0172	1.0147	1.0122	1.0006	0.9984	0.9883	0.9883	0.9864	0.9922	0.9984	1.0028	1.0074 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers													
	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths													
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses													
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy conte	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Energy content (annual)										Total = Sum(45)m =		2270.6369	
Distribution loss (46)m = 0.15 x (45)m													
	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106	(62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2561.0168	(64)
Electric shower(s)												2561	(64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328 (68)
Pumps, fans	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Total internal gains	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186 (72)
	649.7918	666.9541	637.0879	614.0463	580.6224	555.5767	532.5524	533.1488	550.6125	573.3338	610.7261	635.0211 (73)

6. Solar gains

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
East	9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)						
South	4.9500	46.7521	0.6300	0.7000	0.7700	70.7258 (78)						
West	7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)						
East	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)						
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301 (83)
Total gains	832.8483	1003.0497	1148.7150	1313.9453	1409.7254	1394.5274	1335.0934	1239.5349	1128.8774	959.9785	834.7164	788.4512 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934
util living area	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662
	0.9585	0.9324	0.8899	0.8054	0.6858	0.5358	0.4091	0.4519	0.6537	0.8521	0.9370	0.9637 (86)
MIT	18.5904	18.9565	19.4624	20.0821	20.5526	20.8414	20.9451	20.9264	20.7111	20.0636	19.2224	18.5320 (87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772 (88)
util rest of house	0.9528	0.9235	0.8753	0.7798	0.6445	0.4753	0.3328	0.3739	0.5962	0.8264	0.9272	0.9587 (89)
MIT 2	17.2334	17.6953	18.3289	19.0932	19.6458	19.9644	20.0600	20.0478	19.8370	19.0895	18.0431	17.1643 (90)
Living area fraction	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9291	0.8942	0.8427	0.7507	0.6271	0.4720	0.3371	0.3771	0.5843	0.7955	0.8989	0.9368 (94)
Ext temp.	773.8173	896.9516	968.0511	986.3689	883.9748	658.1591	450.0543	467.3885	659.5640	763.6535	750.3385	738.6282 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1769.4619	1745.1944	1609.0412	1370.7655	1067.8954	716.8913	466.3010	490.0119	768.9325	1141.0418	1476.3508	1756.6847 (97)
Space heating requirement - total per year (kWh/year)	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98a)
Solar heating kWh												3762.2177
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3762.2177
Space heating per m2										(98c) / (4) =		28.2449 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	801.6879	616.9039	516.1219	299.5298	148.0919	0.0000	0.0000	0.0000	0.0000	303.8711	565.7239	819.7338 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5392	86.2944	85.8407	84.9773	83.5494	80.3000	80.3000	80.3000	80.3000	84.9813	86.1232	80.3000	(216)
Fuel for water heating, kWh/month	292.5474	259.3517	277.0794	246.7204	243.5920	228.7993	226.2980	235.1710	237.5862	249.8188	261.4254	289.2833	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.1677	-61.7179	-89.9276	-102.4962	-111.6343	-104.5174	-103.1520	-96.7982	-85.8266	-71.1252	-47.7335	-37.2148	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8427	-46.2205	-92.3962	-139.5739	-185.3726	-186.6282	-184.5107	-155.9169	-113.8217	-66.4561	-29.2719	-17.2586	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4071.6642	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3047.6729	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5272.9017	(238)

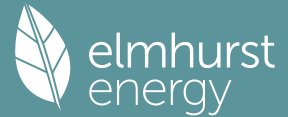
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4071.6642	0.2100	855.0495 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3047.6729	0.2100	640.0113 (264)
Space and water heating			1495.0608 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	0.1343	-128.3138
PV Unit electricity exported	-1239.2700	0.1257	-155.7964
Total			-284.1101 (269)
Total CO2, kg/year			1260.7157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4071.6642	1.1300	4600.9805 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3047.6729	1.1300	3443.8704 (278)
Space and water heating			8044.8509 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	1.4964	-1429.5231
PV Unit electricity exported	-1239.2700	0.4615	-571.8681
Total			-2001.3912 (283)
Total Primary energy kWh/year			6575.6488 (286)
Target Primary Energy Rate (TPER)			49.3700 (287)

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Property Reference	77942-08			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 8, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.13	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

2. Ventilation rate

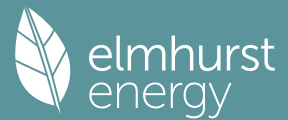
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1276 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3276	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2785 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3550	0.3481	0.3411	0.3063	0.2994	0.2645	0.2645	0.2576	0.2785	0.2994	0.3133	0.3272	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5630	0.5606	0.5582	0.5469	0.5448	0.5350	0.5350	0.5332	0.5388	0.5448	0.5491	0.5535	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199	(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.0831			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12798.1999	(34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

96.0826 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	17.9200	0.0500	0.8960
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	37.1500	0.0500	1.8575
E4 Jamb	21.5800	0.1600	3.4528
E5 Ground floor (normal)	21.1700	0.0900	1.9053
E16 Corner (normal)	14.1100	0.0600	0.8466
E18 Party wall between dwellings	8.7000	0.0800	0.6960
P1 Party wall - Ground floor	4.6500	0.0600	0.2790
P4 Party wall - Roof (insulation at ceiling level)	21.5800	0.0000	0.0000
E6 Intermediate floor within a dwelling	13.5900	0.0400	0.5436
E11 Eaves (insulation at rafter level)	11.5900	0.0800	0.9272
E13 Gable (insulation at rafter level)	5.7100	0.0400	0.2284
R5 Ridge (inverted)	5.8700	0.0800	0.4696
P5 Party wall - Roof (insulation at rafter level)	13.1800	0.0800	1.0544
R4 Ridge (vaulted ceiling)	7.0600	-0.0900	-0.6354
E17 Corner (inverted - internal area greater than external area)	1.1800	0.0800	0.0944
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0800	0.0944
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges	(36a) =	13.7602 (36)
Total fabric heat loss	(33) + (36) + (36a) =	73.8433 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.2414	57.9882	57.7400	56.5744	56.3564	55.3412	55.3412	55.1532	55.7322	56.3564	56.7975	57.2588 (38)
Heat transfer coeff	132.0846	131.8315	131.5833	130.4177	130.1996	129.1844	129.1844	128.9964	129.5755	130.1996	130.6408	131.1020 (39)
Average = Sum(39)m / 12 =												130.4167

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9916	0.9897	0.9879	0.9791	0.9775	0.9699	0.9699	0.9684	0.9728	0.9775	0.9808	0.9842 (40)
HLP (average)												0.9791
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	31.3623 (42b)
Hot water usage for other uses												
44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy conte	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Energy content (annual)										Total = Sum(45)m =		1154.2766
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756	100.7756 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				981.1351 (64)
Electric shower(s)	58.3734	52.0112	56.7942	54.1980	55.2150	52.6698	54.4255	55.2150	54.1980	56.7942	55.7263	58.3734 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				663.9941 (64a)
Heat gains from water heating, kWh/month	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)												
53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775	53.4775 (72)
Total internal gains	578.3220	596.8424	570.1117	554.6307	525.6543	508.3060	488.4925	486.9482	501.8261	516.3071	546.4829	564.5800 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W
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		W/m2	or Table 6b	or Table 6c	Table 6d	

East	9.6300	19.6403	0.3300	0.0000	0.7700	48.0594 (76)
South	4.9500	46.7521	0.3300	0.0000	0.7700	58.8045 (78)
West	7.1300	19.6403	0.3300	0.0000	0.7700	35.5829 (80)
East	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)

Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847 (83)
Total gains	732.5007	880.2434	1002.2413	1146.7503	1227.8270	1219.1168	1168.3339	1084.8482	990.5773	842.5336	735.1995	693.7648 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.9150	26.9667	27.0175	27.2590	27.3047	27.5192	27.5192	27.5593	27.4362	27.3047	27.2124	27.1167
alpha	2.7943	2.7978	2.8012	2.8173	2.8203	2.8346	2.8346	2.8373	2.8291	2.8203	2.8142	2.8078
util living area	0.9688	0.9483	0.9144	0.8422	0.7331	0.5844	0.4519	0.4973	0.6999	0.8816	0.9517	0.9729 (86)
MIT	18.5145	18.8592	19.3505	19.9780	20.4810	20.8086	20.9323	20.9098	20.6641	19.9790	19.1381	18.4553 (87)
Th 2	20.0903	20.0919	20.0935	20.1008	20.1021	20.1085	20.1085	20.1097	20.1061	20.1021	20.0994	20.0965 (88)
util rest of house	0.9645	0.9412	0.9024	0.8197	0.6943	0.5232	0.3713	0.4158	0.6445	0.8597	0.9439	0.9691 (89)
MIT 2	17.7991	18.1397	18.6224	19.2316	19.6988	19.9850	20.0759	20.0638	19.8722	19.2456	18.4242	17.7447 (90)
Living area fraction	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108 (92)
MIT	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108 (93)
Temperature adjustment												0.0000
adjusted MIT	17.8656	18.2066	18.6901	19.3010	19.7715	20.0615	20.1555	20.1424	19.9458	19.3138	18.4906	17.8108 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9498	0.9219	0.8793	0.7965	0.6784	0.5198	0.3757	0.4190	0.6335	0.8363	0.9254	0.9557 (94)
Useful gains	695.7035	811.5369	881.2811	913.3691	833.0149	633.6490	438.9874	454.5606	627.5077	704.5851	680.3337	663.0400 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1791.8125	1754.2302	1604.0148	1356.4710	1050.9060	705.5445	459.3195	482.7570	757.4674	1134.5342	1488.0730	1784.4016 (97)
Space heating kWh	815.5051	633.4899	537.7139	319.0334	162.1109	0.0000	0.0000	0.0000	0.0000	319.8821	581.5723	834.2930 (98a)
Space heating requirement - total per year (kWh/year)												4203.6007
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	815.5051	633.4899	537.7139	319.0334	162.1109	0.0000	0.0000	0.0000	0.0000	319.8821	581.5723	834.2930 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4203.6007
Space heating per m2										(98c) / (4) =		31.5586 (99)

8c. Space cooling requirement

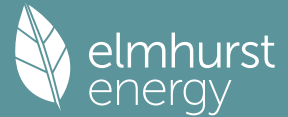
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1214.3336	955.9648	980.3729	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7751	0.8372	0.8074	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	941.1984	800.3441	791.5641	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1342.4679	1286.9138	1194.4815	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	288.9141	362.0078	299.7705	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	72.2285	90.5020	74.9426	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												237.6731 (107)
Energy for space heating												31.5586 (99)
Energy for space cooling												1.7843 (108)
Total												33.3429 (109)
Fabric Energy Efficiency (DFEE)												33.3 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1276 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.3776 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3210 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.0000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											0.0000 (23c)	
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)

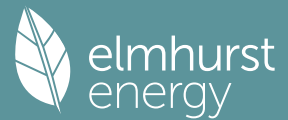
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1500	1.0000	2.1500			(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Velux			1.1400	1.4151	1.6132			(27a)
GF			44.4000	0.1300	5.7720			(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424			(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564			(30)
Total net area of external elements Aum(A, m2)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0928			(33)
Party Wall			43.4800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								96.0826 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				17.9200	0.0500		0.8960	
E3 Sill				17.9200	0.0500		0.8960	
E4 Jamb				37.1500	0.0500		1.8575	
E5 Ground floor (normal)				21.5800	0.1600		3.4528	
E16 Corner (normal)				21.1700	0.0900		1.9053	
E18 Party wall between dwellings				14.1100	0.0600		0.8466	
P1 Party wall - Ground floor				8.7000	0.0800		0.6960	
P4 Party wall - Roof (insulation at ceiling level)				4.6500	0.1200		0.5580	
E6 Intermediate floor within a dwelling				21.5800	0.0000		0.0000	
E11 Eaves (insulation at rafter level)				13.5900	0.0400		0.5436	
E13 Gable (insulation at rafter level)				11.5900	0.0800		0.9272	
R5 Ridge (inverted)				5.7100	0.0400		0.2284	
P5 Party wall - Roof (insulation at rafter level)				5.8700	0.0800		0.4696	
R4 Ridge (vaulted ceiling)				13.1800	0.0800		1.0544	
E17 Corner (inverted - internal area greater than external area)				7.0600	-0.0900		-0.6354	
R1 Head of roof window				1.1800	0.0800		0.0944	
R2 Sill of roof window				1.1800	0.0600		0.0708	
R3 Jamb of roof window				1.9300	0.0800		0.1544	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.0156 (36)
Point Thermal bridges								(36a) = 0.0000
Total fabric heat loss								(33) + (36) + (36a) = 75.1084 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)
Hot water usage for other uses												
	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)
Average daily hot water use (litres/day)												69.5018 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	75.8266	73.7462	71.4751	68.6486	66.1269	63.5064	62.9622	65.2287	67.5533	70.2444	73.0959	75.7202 (44)
Energy content (annual)	120.0908	105.0136	109.8545	93.9765	89.0196	78.0885	76.1473	80.7668	83.3000	95.3210	104.1385	118.5596 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1154.2766
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	102.0772	89.2616	93.3764	79.8800	75.6666	66.3752	64.7252	68.6518	70.8050	81.0229	88.5177	100.7756 (64)
Total per year (kWh/year)											981.1351	(64a)
Electric shower(s)											981	(64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											663.9941	(64a)
Heat gains from water heating, kWh/month												
	40.1126	35.3182	37.5426	33.5195	32.7204	29.7613	29.7877	30.9667	31.2508	34.4543	36.0610	39.7873 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Water heating gains (Table 5)	53.9148	52.5568	50.4605	46.5549	43.9791	41.3351	40.0372	41.6219	43.4038	46.3095	50.0847	53.4775 (72)
Total internal gains	578.3220	596.8424	570.1117	554.6307	525.6543	508.3060	488.4925	486.9482	501.8261	516.3071	546.4829	564.5800 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)			
South				4.9500	46.7521	0.6300	0.7000	0.7700	70.7258 (78)			
West				7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)			
East				1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)			
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301 (83)
Total gains	761.3786	932.9380	1081.7387	1254.5297	1354.7574	1347.2567	1291.0336	1193.3344	1080.0909	902.9518	770.4732	718.0101 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934
alpha	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662
util living area	0.9662	0.9421	0.9021	0.8196	0.7013	0.5497	0.4211	0.4663	0.6713	0.8676	0.9471	0.9708 (86)
MIT	18.4873	18.8638	19.3858	20.0324	20.5248	20.8305	20.9409	20.9203	20.6898	20.0063	19.1357	18.4283 (87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772 (88)
util rest of house	0.9615	0.9342	0.8886	0.7950	0.6605	0.4887	0.3432	0.3868	0.6142	0.8438	0.9386	0.9667 (89)
MIT 2	17.7580	18.1296	18.6411	19.2666	19.7198	19.9854	20.0652	20.0549	19.8769	19.2570	18.4089	17.7050 (90)
Living area fraction	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723 (91)
MIT	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8258	18.1978	18.7103	19.3378	19.7946	20.0640	20.1466	20.1353	19.9525	19.3267	18.4764	17.7723 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9457	0.9136	0.8643	0.7721	0.6464	0.4866	0.3480	0.3905	0.6047	0.8199	0.9188	0.9524 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (95)
Heat loss rate W	1832.6277	1797.2693	1646.2606	1391.1154	1076.4795	719.2732	466.8710	490.7798	773.4523	1160.5380	1519.5909	1821.2117 (97)
Space heating kWh	827.7471	635.0209	529.2226	304.2197	149.3791	0.0000	0.0000	0.0000	0.0000	312.6578	584.3828	846.1946 (98a)
Space heating requirement - total per year (kWh/year)												4188.8246
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	827.7471	635.0209	529.2226	304.2197	149.3791	0.0000	0.0000	0.0000	0.0000	312.6578	584.3828	846.1946 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4188.8246
Space heating per m ²												31.4476 (99)

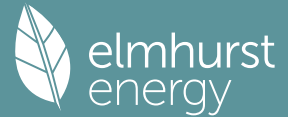
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----- 8c. Space cooling requirement -----

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1237.4041	974.1266	998.5561	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8015	0.8583	0.8300	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	991.7561	836.0981	828.8413	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1492.2418	1430.3290	1321.2834	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	360.3497	442.1078	366.3769	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	90.0874	110.5269	91.5942	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												292.2086 (107)
Energy for space heating												31.4476 (99)
Energy for space cooling												2.1938 (108)
Total												33.6414 (109)
Fabric Energy Efficiency (TFEE)												33.6 (109)

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Property Reference	77942-08			Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	NDS-33 (Semi)		
Property	Plot 8, Chapel Street, MANCHESTER, M19 3QB				
SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.13	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37
Assessor Details	Mr. Paul Goddard			Assessor ID	B342-0001
Client					

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	44.4000 (1b)	x	2.3000 (2b)	=	102.1200 (1b)	- (3b)
First floor	44.4000 (1c)	x	2.5400 (2c)	=	112.7760 (1c)	- (3c)
Second floor	44.4000 (1d)	x	2.2200 (2d)	=	98.5680 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640	(5)

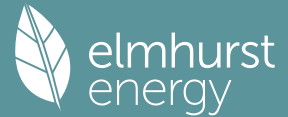
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1700 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Window (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Door			2.1500	1.2000	2.5800			(26)
Velux			1.1400	1.5038	1.7143			(27a)
GF			44.4000	0.1200	5.3280	75.0000	3330.0000	(28a)
Main	133.5400	23.8600	109.6800	0.1700	18.6456	9.0000	987.1199	(29a)
PIU	64.3800	1.1400	63.2400	0.1100	6.9564	9.0000	569.1600	(30)
Total net area of external elements Aum(A, m ²)			242.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0831			(33)
Party Wall			43.4800	0.0000	0.0000	110.0000	4782.7999	(32)
Timber			81.2800			9.0000	731.5200	(32c)
FF			44.4000			18.0000	799.2000	(32d)
Internal Floor 2			44.4000			18.0000	799.2000	(32d)
GF			44.4000			9.0000	399.6000	(32e)
Internal Ceiling 2			44.4000			9.0000	399.6000	(32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 12798.1999 (34)
96.0826 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	17.9200	0.0500	0.8960
E4 Jamb	37.1500	0.0500	1.8575
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.0600	0.2790
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0800	0.0944
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges
Total fabric heat loss

(36a) = 0.0000
(33) + (36) + (36a) = 73.8433 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	51.7216	(39)
Average = Sum(39)m / 12 =	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648	125.5648

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	0.9427	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

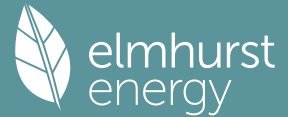
Assumed occupancy													2.9028 (42)
Hot water usage for mixer showers	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116	(42a)
Hot water usage for baths	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623	(42b)
Hot water usage for other uses	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579	(42c)
Average daily hot water use (litres/day)													136.7047 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318	(44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517	(45)
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	1.5879	1.4614	1.6221	1.5076	1.5237	1.4280	1.4227	1.4351	1.4024	1.4929	1.4986	1.5768	(61)
Total heat required for water heating calculated for each month	237.1199	208.7108	219.3702	187.4024	177.8994	156.2174	151.2827	159.6311	163.9535	187.6895	205.4906	233.8285	(62)
WWHRS	-25.9736	-22.9713	-24.0542	-19.9179	-18.5627	-15.8843	-14.8890	-15.8329	-16.4345	-19.3744	-21.9489	-25.4927	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358	(64)
12Total per year (kWh/year)													2047.2598 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	78.7114	69.2758	72.8068	62.1869	59.0259	51.8245	50.1841	52.9590	54.3988	62.2836	68.2020	77.6179	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	(71)
Water heating gains (Table 5)	105.7949	103.0889	97.8586	86.3707	79.3358	71.9784	67.4518	71.1814	75.5539	83.7145	94.7250	104.3251	(72)
Total internal gains	633.2020	650.3745	620.5097	597.4465	564.0111	538.9493	515.9071	516.5077	533.9762	556.7121	594.1231	618.4277	(73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
East	9.6300				19.6403	0.3300	0.0000	0.7700			48.0594 (76)	
South	4.9500				46.7521	0.3300	0.0000	0.7700			58.8045 (78)	
West	7.1300				19.6403	0.3300	0.0000	0.7700			35.5829 (80)	
East	1.1400				25.9287	0.6300	0.7000	1.0000			11.7319 (82)	
Solar gains	154.1787	283.4010	432.1296	592.1197	702.1727	710.8108	679.8414	597.9000	488.7512	326.2265	188.7166	129.1847 (83)
Total gains	787.3807	933.7755	1052.6393	1189.5662	1266.1838	1249.7601	1195.7485	1114.4077	1022.7274	882.9386	782.8398	747.6124 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125	28.3125
alpha	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875	2.8875
util living area	0.9622	0.9391	0.9016	0.8255	0.7120	0.5648	0.4339	0.4777	0.6784	0.8662	0.9430	0.9671 (86)
MIT	18.7334	19.0628	19.5249	20.0906	20.5494	20.8346	20.9431	20.9235	20.7079	20.0842	19.2956	18.6536 (87)
Th 2	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314	20.1314 (88)
util rest of house	0.9572	0.9312	0.8886	0.8022	0.6731	0.5053	0.3572	0.3998	0.6234	0.8429	0.9342	0.9627 (89)
MIT 2	17.4511	17.8663	18.4456	19.1411	19.6831	19.9946	20.0961	20.0813	19.8712	19.1485	18.1661	17.3501 (90)
Living area fraction	fLA = Living area / (4) = 0.0929 (91)											
MIT	17.5703	17.9775	18.5459	19.2293	19.7636	20.0726	20.1748	20.1596	19.9490	19.2354	18.2711	17.4712 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.4203	17.8275	18.3959	19.0793	19.6136	19.9226	20.0248	20.0096	19.7990	19.0854	18.1211	17.3212 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.9026	0.8554	0.7688	0.6473	0.4900	0.3474	0.3882	0.5999	0.8079	0.9059	0.9415 (94)
Useful gains	735.6862	842.8314	900.4432	914.5502	819.6015	612.4077	415.3892	432.5978	613.4854	713.3261	709.1754	703.8837 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1647.4473	1623.2443	1493.7054	1278.1661	993.6751	668.3363	430.0351	453.2400	715.5902	1065.4716	1383.8615	1647.5657 (97)
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98a)
Space heating requirement - total per year (kWh/year)												3485.3586
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3485.3586
Space heating per m2	(98c) / (4) =											26.1664 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												88.6000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.3502	524.4375	441.3870	261.8035	129.5108	0.0000	0.0000	0.0000	0.0000	261.9963	485.7740	702.0994 (98)
Space heating efficiency (main heating system 1)	88.6000	88.6000	88.6000	88.6000	88.6000	0.0000	0.0000	0.0000	0.0000	88.6000	88.6000	88.6000 (210)
Space heating fuel (main heating system)	765.6323	591.9159	498.1795	295.4893	146.1747	0.0000	0.0000	0.0000	0.0000	295.7068	548.2776	792.4373 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	211.1463	185.7395	195.3160	167.4846	159.3367	140.3331	136.3937	143.7982	147.5190	168.3151	183.5417	208.3358 (64)
Efficiency of water heater (217)m	86.5879	86.3882	86.0169	85.3406	84.0607	80.7000	80.7000	80.7000	80.7000	85.3326	86.2837	86.6588 (217)
Fuel for water heating, kWh/month	243.8519	215.0056	227.0670	196.2542	189.5497	173.8948	169.0133	178.1886	182.7993	197.2460	212.7187	240.4095 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	12.3147	11.1229	12.3147	11.9174	12.3147	11.9174	12.3147	12.3147	11.9174	12.3147	11.9174	12.3147 (231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.2974	-43.3211	-70.5575	-87.8669	-100.5010	-95.7200	-94.0595	-85.5415	-70.9764	-52.7117	-31.3558	-22.8726 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-9.7413	-23.6118	-55.6940	-96.8927	-139.6238	-144.8224	-141.4485	-112.6191	-73.2446	-36.3165	-13.6210	-7.4004 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	3933.8133	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.7000	
Water heating fuel used	2425.9987	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	58.9956	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	144.9956	(231)
Electricity for lighting (calculated in Appendix L)	262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1637.8174	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5129.1362	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3933.8133	0.2100	826.1008 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.9987	0.2100	509.4597 (264)
Space and water heating			1335.5605 (265)
Pumps, fans and electric keep-hot	144.9956	0.1387	20.1127 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	0.1326	-103.8058
PV Unit electricity exported	-855.0362	0.1224	-104.6445
Total			-208.4502 (269)
Total CO2, kg/year			1185.0588 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.9000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3933.8133	1.1300	4445.2091 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.9987	1.1300	2741.3786 (278)
Space and water heating			7186.5877 (279)
Pumps, fans and electric keep-hot	144.9956	1.5128	219.3493 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.7813	1.4900	-1166.3460
PV Unit electricity exported	-855.0362	0.4491	-383.9712
Total			-1550.3172 (283)
Total Primary energy kWh/year			6257.7080 (286)
Dwelling Primary energy Rate (DPER)			46.9800 (287)

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

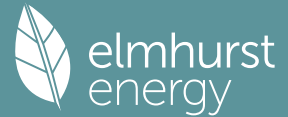
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	44.4000 (1b)	x 2.3000 (2b)	= 102.1200 (1b) - (3b)
First floor	44.4000 (1c)	x 2.5400 (2c)	= 112.7760 (1c) - (3c)
Second floor	44.4000 (1d)	x 2.2200 (2d)	= 98.5680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.4640 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1276 (8)

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Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3776 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3210 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.4092	0.4012	0.3932	0.3531	0.3450	0.3049	0.3049	0.2969	0.3210	0.3450	0.3611	0.3771 (22b)
	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Velux			1.1400	1.4151	1.6132		(27a)
GF			44.4000	0.1300	5.7720		(28a)
Main	133.5400	23.8600	109.6800	0.1800	19.7424		(29a)
PIJ	64.3800	1.1400	63.2400	0.1100	6.9564		(30)
Total net area of external elements Aum(A, m2)			242.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0928		(33)
Party Wall			43.4800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.0826 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.9200	0.0500	0.8960
E3 Sill	17.9200	0.0500	0.8960
E4 Jamb	37.1500	0.0500	1.8575
E5 Ground floor (normal)	21.5800	0.1600	3.4528
E16 Corner (normal)	21.1700	0.0900	1.9053
E18 Party wall between dwellings	14.1100	0.0600	0.8466
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P4 Party wall - Roof (insulation at ceiling level)	4.6500	0.1200	0.5580
E6 Intermediate floor within a dwelling	21.5800	0.0000	0.0000
E11 Eaves (insulation at rafter level)	13.5900	0.0400	0.5436
E13 Gable (insulation at rafter level)	11.5900	0.0800	0.9272
R5 Ridge (inverted)	5.7100	0.0400	0.2284
P5 Party wall - Roof (insulation at rafter level)	5.8700	0.0800	0.4696
R4 Ridge (vaulted ceiling)	13.1800	0.0800	1.0544
E17 Corner (inverted - internal area greater than external area)	7.0600	-0.0900	-0.6354
R1 Head of roof window	1.1800	0.0800	0.0944
R2 Sill of roof window	1.1800	0.0600	0.0708
R3 Jamb of roof window	1.9300	0.0800	0.1544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0156 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.1084 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.3834	60.0470	59.7173	58.1688	57.8791	56.5303	56.5303	56.2806	57.0499	57.8791	58.4652	59.0779 (38)
Average = Sum(39)m / 12 =	135.4918	135.1554	134.8257	133.2772	132.9875	131.6387	131.6387	131.3890	132.1582	132.9875	133.5736	134.1863 (39)

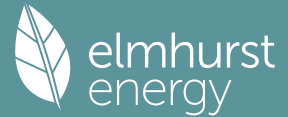
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0172	1.0147	1.0122	1.0006	0.9984	0.9883	0.9883	0.9864	0.9922	0.9984	1.0028	1.0074 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9028 (42)
Hot water usage for mixer showers												
Hot water usage for baths	72.8908	71.7954	70.1992	67.1451	64.8913	62.3778	60.9492	62.5333	64.2698	66.9685	70.0882	72.6116 (42a)
Hot water usage for other uses	31.4687	31.0013	30.3432	29.1297	28.2211	27.2135	26.6693	27.3228	28.0344	29.1125	30.3510	31.3623 (42b)
Average daily hot water use (litres/day)	44.3579	42.7449	41.1319	39.5189	37.9059	36.2929	36.2929	37.9059	39.5189	41.1319	42.7449	44.3579 (42c)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	148.7174	145.5417	141.6743	135.7937	131.0182	125.8842	123.9113	127.7620	131.8231	137.2129	143.1841	148.3318 (44)
Energy content (annual)	235.5321	207.2494	217.7481	185.8948	176.3757	154.7893	149.8600	158.1961	162.5511	186.1966	203.9920	232.2517 (45)
Distribution loss (46)m = 0.15 x (45)m	35.3298	31.0874	32.6622	27.8842	26.4564	23.2184	22.4790	23.7294	24.3827	27.9295	30.5988	34.8378 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	286.4910	253.2768	268.7070	235.2099	227.3346	204.1044	200.8189	209.1550	211.8662	237.1556	253.3071	283.2106 (62)
WWHRS	-33.3226	-29.4708	-30.8601	-25.5534	-23.8149	-20.3786	-19.1016	-20.3127	-21.0844	-24.8562	-28.1591	-32.7056 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051 (64)
12Total per year (kWh/year)												2561.0168 (64)
Electric shower(s)												2561 (64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	91.0541	80.4173	85.1410	74.1388	71.3846	63.7962	62.5682	65.3399	66.3770	74.6501	80.1561	89.9634 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418	145.1418 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.3272	173.0766	156.3272	161.5381	156.3272	161.5381	156.3272	156.3272	161.5381	156.3272	161.5381	156.3272 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	301.5374	304.6664	296.7814	279.9952	258.8055	238.8902	225.5856	222.4566	230.3416	247.1279	268.3175	288.2328 (68)
Pumps, fans	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142	37.5142 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134	-116.1134 (71)
Total internal gains	122.3846	119.6686	114.4368	102.9705	95.9471	88.6059	84.0970	87.8225	92.1903	100.3362	111.3279	120.9186 (72)
	649.7918	666.9541	637.0879	614.0463	580.6224	555.5767	532.5524	533.1488	550.6125	573.3338	610.7261	635.0211 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
East	9.6300	19.6403	0.6300	0.7000	0.7700	57.8023 (76)						
South	4.9500	46.7521	0.6300	0.7000	0.7700	70.7258 (78)						
West	7.1300	19.6403	0.6300	0.7000	0.7700	42.7965 (80)						
East	1.1400	25.9287	0.6300	0.7000	1.0000	11.7319 (82)						
Solar gains	183.0565	336.0956	511.6270	699.8990	829.1031	838.9507	802.5410	706.3861	578.2648	386.6447	223.9903	153.4301 (83)
Total gains	832.8483	1003.0497	1148.7150	1313.9453	1409.7254	1394.5274	1335.0934	1239.5349	1128.8774	959.9785	834.7164	788.4512 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	26.2382	26.3035	26.3678	26.6742	26.7323	27.0062	27.0062	27.0575	26.9000	26.7323	26.6150	26.4934
util living area	2.7492	2.7536	2.7579	2.7783	2.7822	2.8004	2.8004	2.8038	2.7933	2.7822	2.7743	2.7662
	0.9585	0.9324	0.8899	0.8054	0.6858	0.5358	0.4091	0.4519	0.6537	0.8521	0.9370	0.9637 (86)
MIT	18.5904	18.9565	19.4624	20.0821	20.5526	20.8414	20.9451	20.9264	20.7111	20.0636	19.2224	18.5320 (87)
Th 2	20.0690	20.0711	20.0732	20.0829	20.0847	20.0931	20.0931	20.0947	20.0899	20.0847	20.0810	20.0772 (88)
util rest of house	0.9528	0.9235	0.8753	0.7798	0.6445	0.4753	0.3328	0.3739	0.5962	0.8264	0.9272	0.9587 (89)
MIT 2	17.2334	17.6953	18.3289	19.0932	19.6458	19.9644	20.0600	20.0478	19.8370	19.0895	18.0431	17.1643 (90)
Living area fraction	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3596	17.8125	18.4342	19.1851	19.7300	20.0459	20.1423	20.1295	19.9183	19.1801	18.1527	17.2914 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9291	0.8942	0.8427	0.7507	0.6271	0.4720	0.3371	0.3771	0.5843	0.7955	0.8989	0.9368 (94)
Ext temp.	773.8173	896.9516	968.0511	986.3689	883.9748	658.1591	450.0543	467.3885	659.5640	763.6535	750.3385	738.6282 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1769.4619	1745.1944	1609.0412	1370.7655	1067.8954	716.8913	466.3010	490.0119	768.9325	1141.0418	1476.3508	1756.6847 (97)
Space heating requirement - total per year (kWh/year)	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98a)
Solar heating kWh												3762.2177
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3762.2177
Space heating per m2										(98c) / (4) =		28.2449 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	740.7596	570.0192	476.8966	276.7655	136.8369	0.0000	0.0000	0.0000	0.0000	280.7769	522.7289	757.4340 (98)
Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating efficiency (main heating system 2)	801.6879	616.9039	516.1219	299.5298	148.0919	0.0000	0.0000	0.0000	0.0000	303.8711	565.7239	819.7338 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	253.1683	223.8060	237.8469	209.6564	203.5197	183.7258	181.7173	188.8423	190.7817	212.2993	225.1480	250.5051	(64)
Efficiency of water heater	86.5392	86.2944	85.8407	84.9773	83.5494	80.3000	80.3000	80.3000	80.3000	84.9813	86.1232	80.3000	(216)
Fuel for water heating, kWh/month	292.5474	259.3517	277.0794	246.7204	243.5920	228.7993	226.2980	235.1710	237.5862	249.8188	261.4254	289.2833	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.4817	26.0580	23.4624	17.1895	13.2777	10.8480	12.1124	15.7441	20.4500	26.8315	30.3062	33.3845	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.1677	-61.7179	-89.9276	-102.4962	-111.6343	-104.5174	-103.1520	-96.7982	-85.8266	-71.1252	-47.7335	-37.2148	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.8427	-46.2205	-92.3962	-139.5739	-185.3726	-186.6282	-184.5107	-155.9169	-113.8217	-66.4561	-29.2719	-17.2586	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4071.6642	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3047.6729	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												262.1460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2194.5813	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5272.9017	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4071.6642	0.2100	855.0495 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3047.6729	0.2100	640.0113 (264)
Space and water heating			1495.0608 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	262.1460	0.1443	37.8358 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	0.1343	-128.3138
PV Unit electricity exported	-1239.2700	0.1257	-155.7964
Total			-284.1101 (269)
Total CO2, kg/year			1260.7157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4071.6642	1.1300	4600.9805 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3047.6729	1.1300	3443.8704 (278)
Space and water heating			8044.8509 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	262.1460	1.5338	402.0882 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-955.3113	1.4964	-1429.5231
PV Unit electricity exported	-1239.2700	0.4615	-571.8681
Total			-2001.3912 (283)
Total Primary energy kWh/year			6575.6488 (286)
Target Primary Energy Rate (TPER)			49.3700 (287)

Predicted Energy Assessment



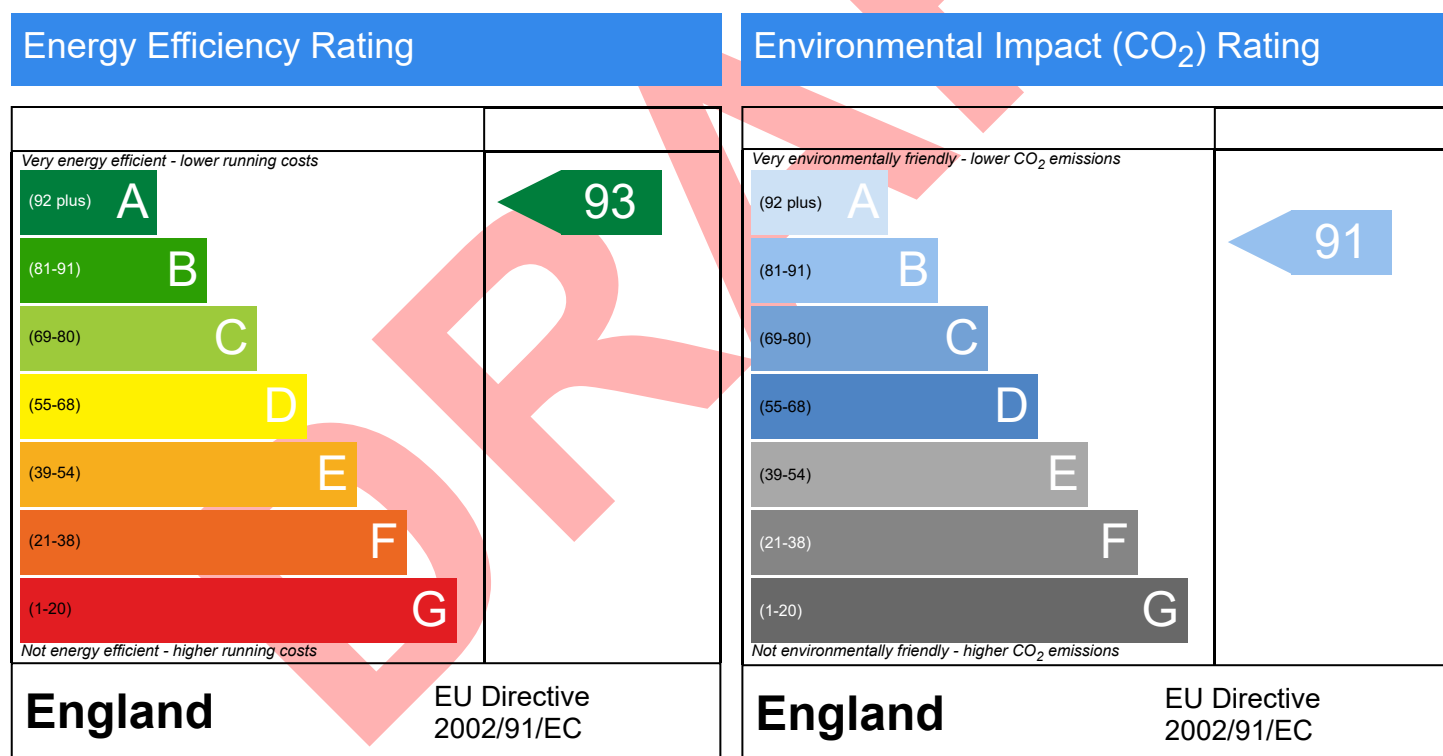
Plot 1, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment



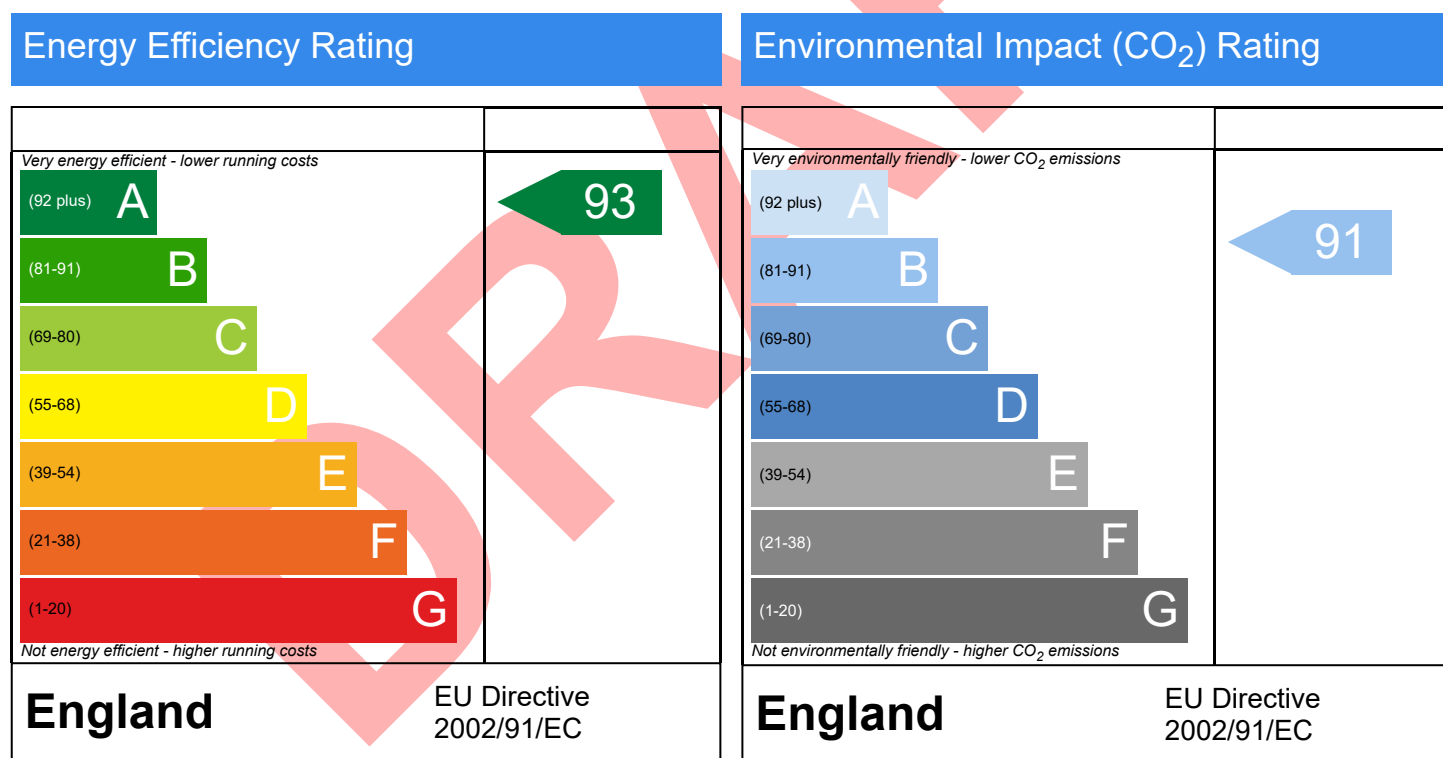
Plot 2, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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Predicted Energy Assessment



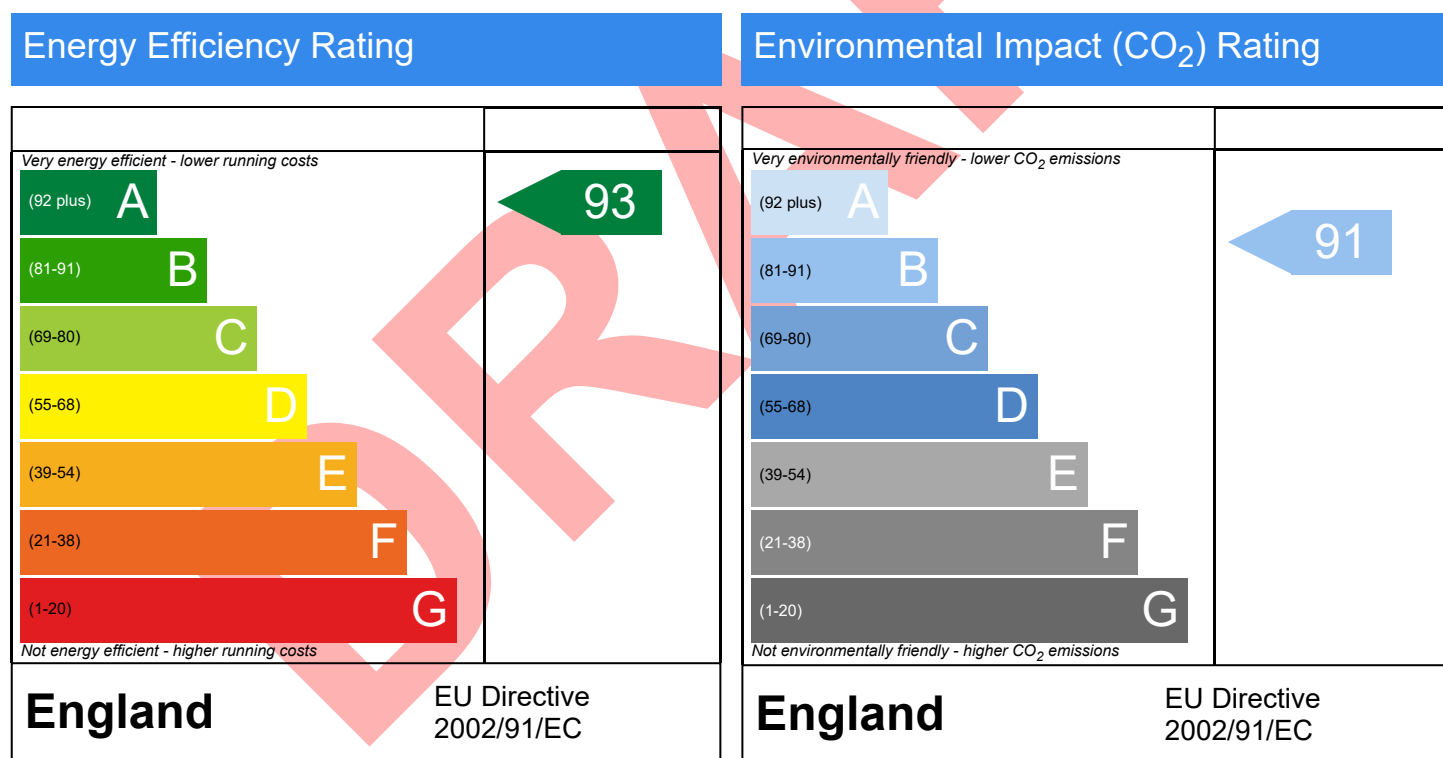
Plot 3, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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Predicted Energy Assessment



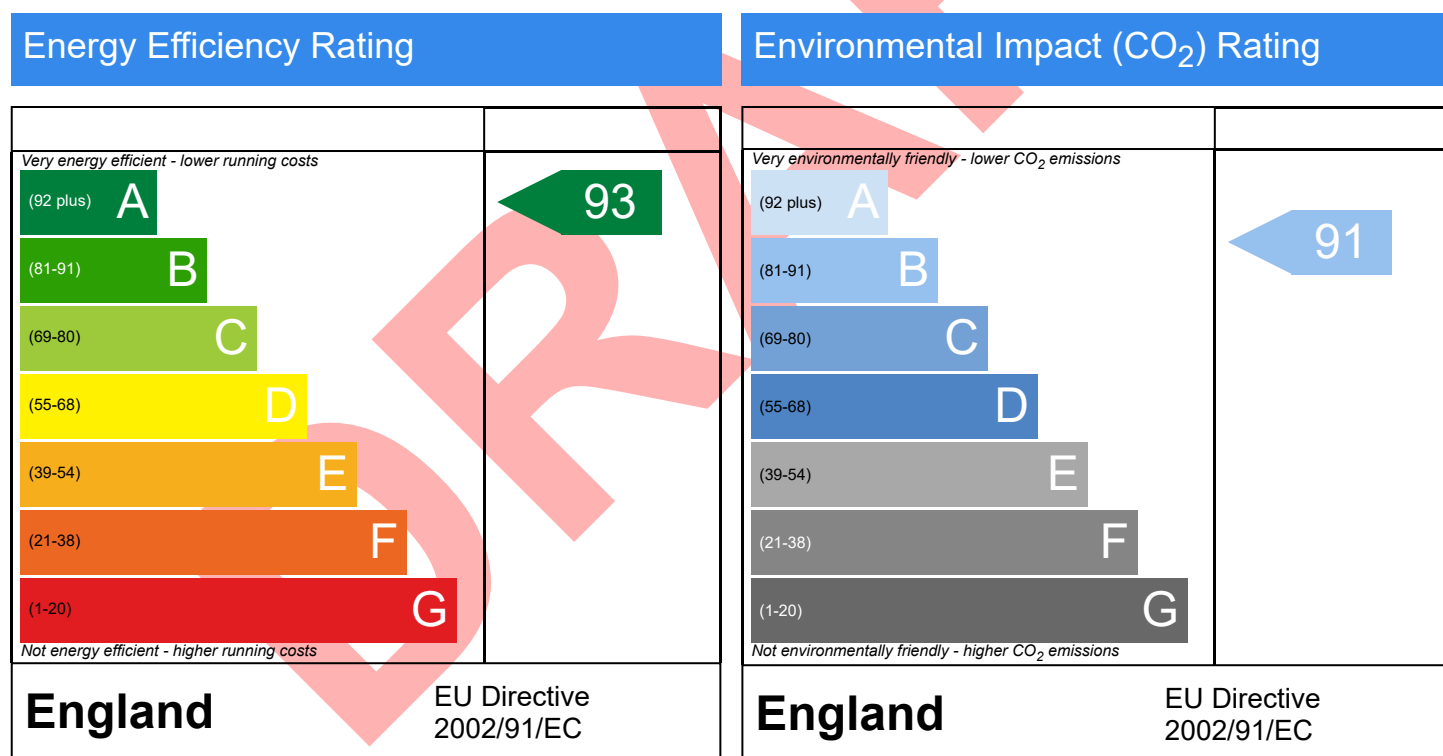
Plot 4, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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

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Predicted Energy Assessment



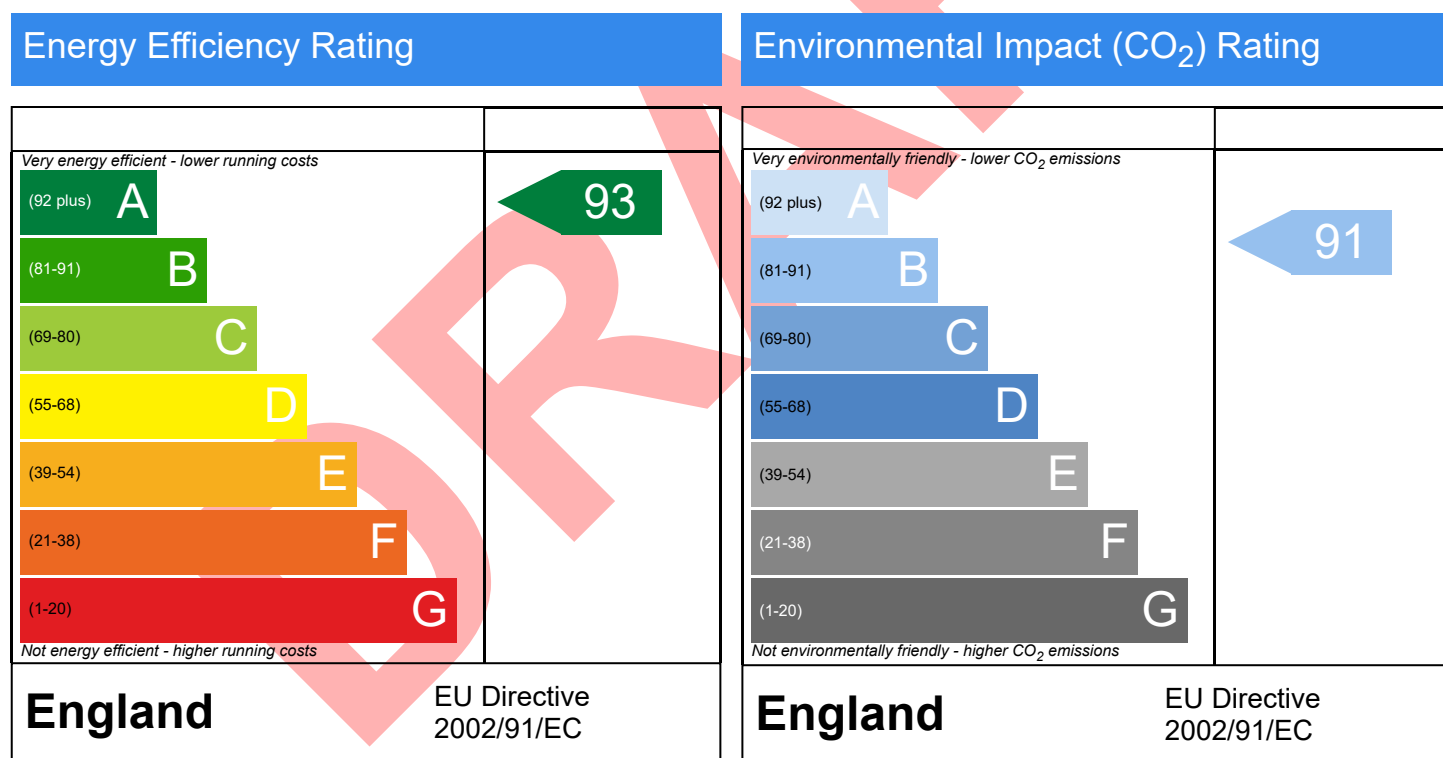
Plot 5, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment



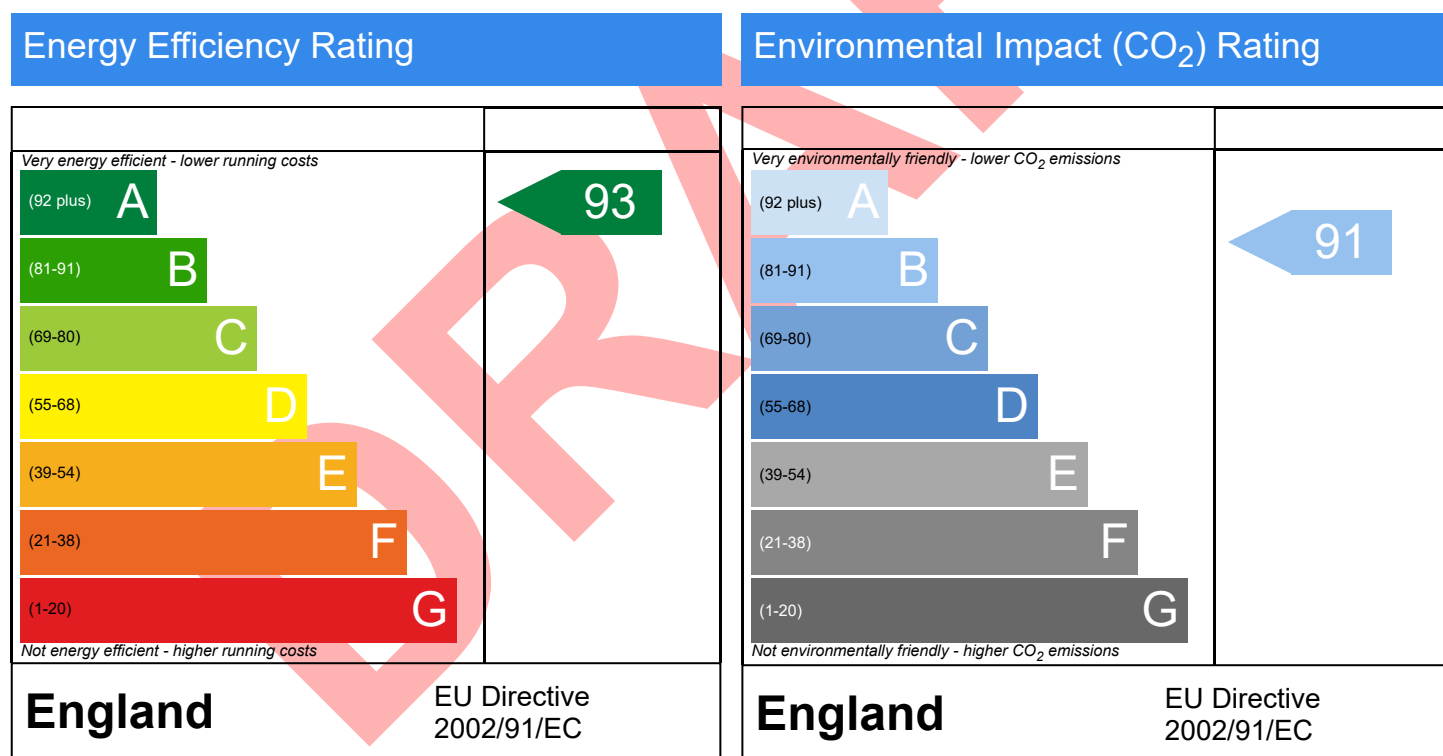
Plot 6, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment



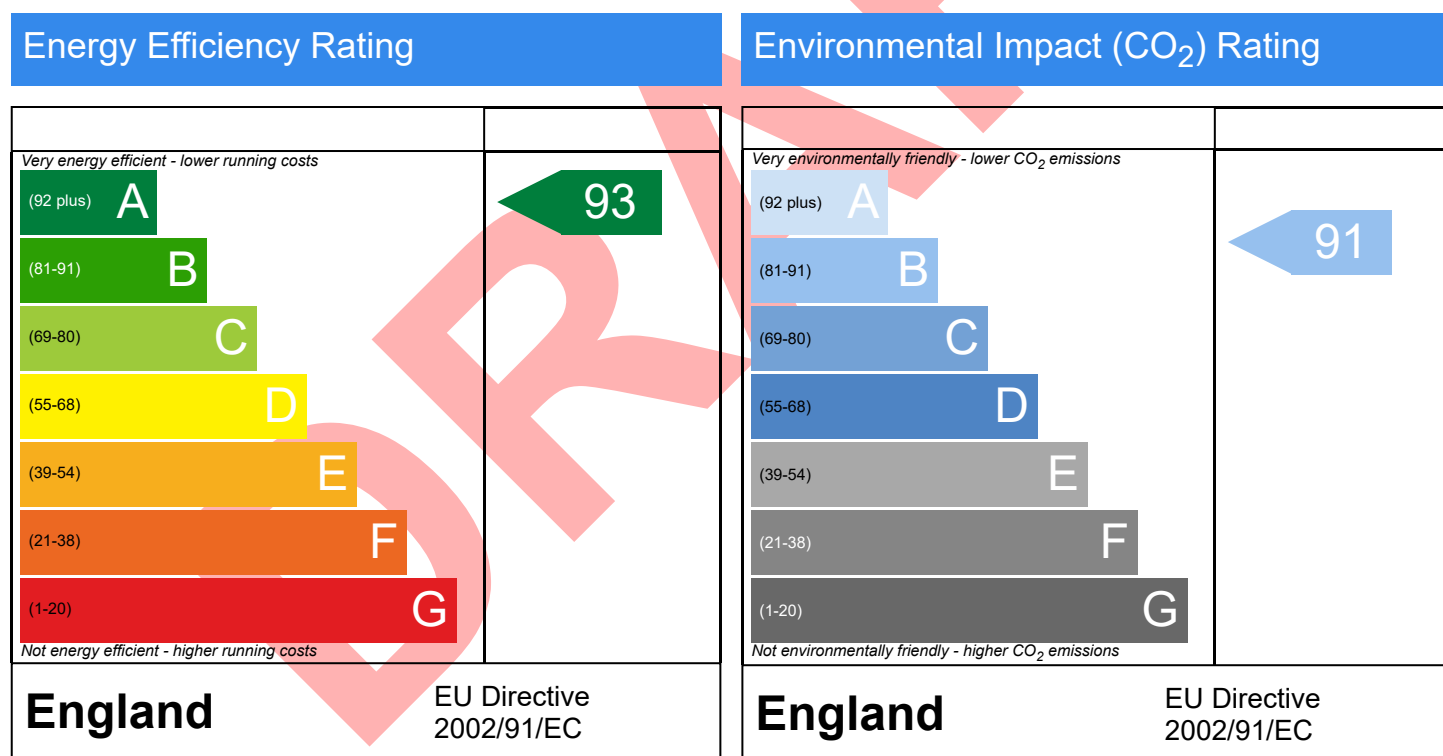
Plot 7, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment



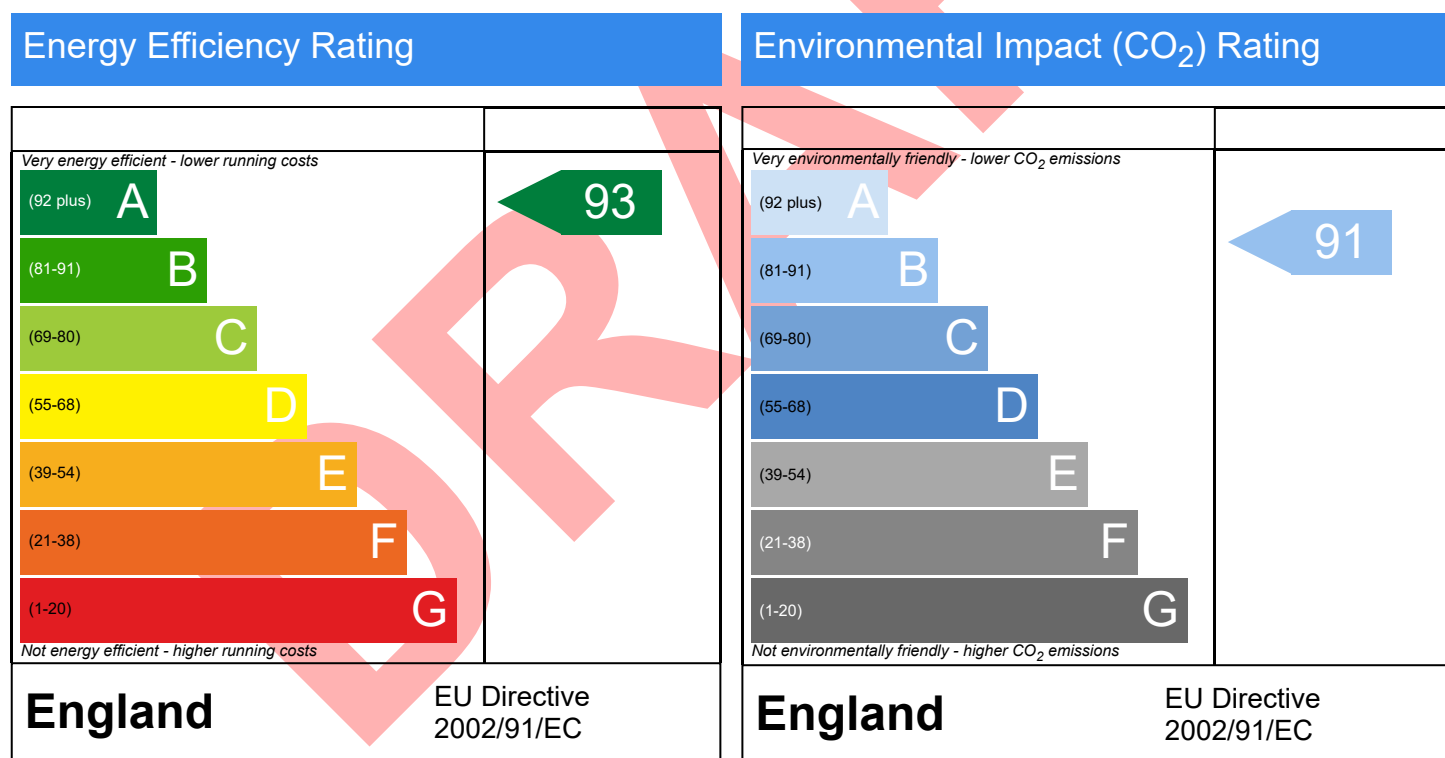
Plot 8, Chapel Street, MANCHESTER, M19 3QB

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Semi-Detached
18/12/2024
Paul Goddard
133.2 m²

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

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Thermal Bridging

Property Reference	77942-01	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 1, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.1	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	17.92	0.90	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	17.92	0.90	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	37.15	1.86	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 226.07 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-02	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 2, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-03	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 3, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-04	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 4, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-05	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 5, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-06	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 6, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging

Property Reference	77942-07	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 7, Chapel Street, MANCHESTER, M19 3QB		

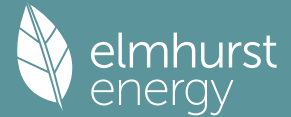
SAP Rating	93 A	DER	8.86	TER	9.51
Environmental	91 B	% DER < TER			6.83
CO ₂ Emissions (t/year)	1.09	DFEE	32.78	TFEE	33.33
Compliance Check	See BREL	% DFEE < TFEE			1.64
% DPER < TPER	5.63	DPER	46.86	TPER	49.66

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	13.83	0.69	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	27.47	1.37	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 208.21 W/mK:
Y-Value: W/m²K:

Thermal Bridging



Property Reference	77942-08	Issued on Date	18/12/2024
Assessment Reference	001	Prop Type Ref	Semi-Detached House
Property	Plot 8, Chapel Street, MANCHESTER, M19 3QB		

SAP Rating	93 A	DER	8.90	TER	9.46
Environmental	91 B	% DER < TER			5.92
CO ₂ Emissions (t/year)	1.1	DFEE	33.34	TFEE	33.64
Compliance Check	See BREL	% DFEE < TFEE			0.89
% DPER < TPER	4.84	DPER	46.98	TPER	49.37

Assessor Details	Mr. Paul Goddard	Assessor ID	B342-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	17.92	0.90	To be confirmed
External wall	E3 Sill	Independently assessed	0.050	17.92	0.90	To be confirmed
External wall	E4 Jamb	Independently assessed	0.050	37.15	1.86	To be confirmed
External wall	E5 Ground floor (normal)	Independently assessed	0.160	21.58	3.45	To be confirmed
External wall	E16 Corner (normal)	Independently assessed	0.090	21.17	1.91	To be confirmed
External wall	E18 Party wall between dwellings	Independently assessed	0.060	14.11	0.85	To be confirmed
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	8.70	0.70	To be confirmed
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.060	4.65	0.28	To be confirmed
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.58	0.00	To be confirmed
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	13.59	0.54	To be confirmed
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.080	11.59	0.93	To be confirmed
External roof	R5 Ridge (inverted)	Independently assessed	0.040	5.71	0.23	To be confirmed
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.080	5.87	0.47	To be confirmed
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	0.080	13.18	1.05	To be confirmed
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.090	7.06	-0.64	To be confirmed
External roof	R1 Head of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R2 Sill of roof window	Independently assessed	0.080	1.18	0.09	To be confirmed
External roof	R3 Jamb of roof window	Independently assessed	0.080	1.93	0.15	To be confirmed

Total: 226.07 W/mK:
Y-Value: W/m²K:

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:54

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-01	Plot Reference	001
Address	Plot 1 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.46 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.9 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.37 kWh _{PE} /m ²		
Dwelling primary energy	46.98 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.6 kWh/m ²		
Dwelling fabric energy efficiency	33.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	109.68	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	East	1.0	1.2
Rear, Window	9.63	West	1.0	1.2
Front, Door	2.15	East	N/A	1.2
Side, Window	4.95	South	1.0	1.2
Velux, Rooflights	1.14	West	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:55

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-02	Plot Reference	001
Address	Plot 2 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	East	1.0	1.2
Rear, Window	9.63	West	1.0	1.2
Front, Door	2.15	East	N/A	1.2
Velux, Rooflights	1.14	West	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:55

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-03	Plot Reference	001
Address	Plot 3 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	East	1.0	1.2
Rear, Window	9.63	West	1.0	1.2
Front, Door	2.15	East	N/A	1.2
Velux, Rooflights	1.14	West	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:56

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-04	Plot Reference	001
Address	Plot 4 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	East	1.0	1.2
Rear, Window	9.63	West	1.0	1.2
Front, Door	2.15	East	N/A	1.2
Velux, Rooflights	1.14	West	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:57

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-05	Plot Reference	001
Address	Plot 5 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	West	1.0	1.2
Rear, Window	9.63	East	1.0	1.2
Front, Door	2.15	West	N/A	1.2
Velux, Rooflights	1.14	East	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:57

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-06	Plot Reference	001
Address	Plot 6 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	West	1.0	1.2
Rear, Window	9.63	East	1.0	1.2
Front, Door	2.15	West	N/A	1.2
Velux, Rooflights	1.14	East	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 18 Dec 2024 20:54:58

Project Information			
Assessed By	Paul Goddard	Building Type	House, Semi-detached
OCDEA Registration	EES/005113	Assessment Date	2024-12-18

Dwelling Details			
Assessment Type	As designed	Total Floor Area	133 m ²
Site Reference	77942-07	Plot Reference	001
Address	Plot 7 Chapel Street, MANCHESTER, M19 3QB		

Client Details	
Name	-
Company	Burke Developments
Address	77 Grange Avenue, MANCHESTER, M19 2FZ

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.51 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.86 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	49.66 kWh _{PE} /m ²		
Dwelling primary energy	46.86 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	33.3 kWh/m ²		
Dwelling fabric energy efficiency	32.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.12	GF (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.22	Velux (1.6)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	114.63	0.17	
Party wall: Party Wall (1)	43.48	0 (!)	
Ground floor: GF, GF	44.4	0.12	
Exposed roof: Roof (1)	63.24	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front, Window	7.13	West	1.0	1.2
Rear, Window	9.63	East	1.0	1.2
Front, Door	2.15	West	N/A	1.2
Velux, Rooflights	1.14	East	0.7	1.6

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	To be confirmed

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	To be confirmed
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	To be confirmed
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	To be confirmed
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	To be confirmed
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	To be confirmed
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	To be confirmed
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	To be confirmed
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	To be confirmed
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	To be confirmed
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	0.08	To be confirmed
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	To be confirmed
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.08	To be confirmed
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	To be confirmed

3 Air permeability (better than typically expected values are flagged with a subsequent (!))			
Maximum permitted air permeability at 50Pa	8 m ³ /hm ²		
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value		OK
Air permeability test certificate reference			

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.6%
Emitter type	Radiators
Flow temperature	55°C
System type	
Manufacturer	Vaillant Group UK Ltd
Model	ecoTEC plus 836
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	57.3%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21C	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.15 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	Lo-Carbon NBR dMEV C 100, 498095	
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2.4 kWp	
Orientation	West	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

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