

Complete Compliance for Property Professionals

Building Regulations (England) Part L
SAP As-Designed Compliance Report

401 Wilbraham Road

Chorlton

Manchester

M21 0UT

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 07 Apr 2026 11:14:09

Project Information			
Assessed By	Daniel Crew	Building Type	House, Detached
OCDEA Registration	EES/030055	Assessment Date	2026-04-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	416 m^2
Site Reference	401 Wilbraham Road	Plot Reference	401 Wilbraham Road
Address	401 Wilbraham Road, Manchester, M21 0UT		

Client Details	
Name	Omar Fiaz
Company	.
Address	., ., .

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	*7.63 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.04 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*40.76 kWh_{PE}/m^2*	
Dwelling primary energy	39.89 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.3 kWh/m^2*	
Dwelling fabric energy efficiency	37.7 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.16	Walls (1) (0.17)	**OK**
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.11	Ground Floor (0.11)	**OK**
Roofs	*0.16*	0.16	Roof (2) (0.17)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	R1 (1.21)	**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^2K]**
Exposed wall: Walls (1)	242.3319	0.17
Exposed wall: Walls (2)	66.19	0.11 **(!)**
Ground floor: Ground Floor, Ground Floor	181.28	0.11
Exposed roof: Roof (1)	146.246	0.15
Exposed roof: Roof (2)	53.57	0.17

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
R1, Roof Window	0.792	North	1.0	1.21
R1, Roof Window	0.792	North	1.0	1.21
R1, Roof Window	0.792	North	1.0	1.21
W1, Window	1.32	North	1.0	1.21
W1, Window	1.32	North	1.0	1.21
W1, Window	1.32	North	1.0	1.21
W1, Window	1.32	North	1.0	1.21
W2, Window	4.284	North	1.0	1.21
W3, Window	1.2	North	1.0	1.21
W3, Window	1.2	North	1.0	1.21
W3, Window	1.2	North	1.0	1.21
W3, Window	1.2	North	1.0	1.21

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]
W4, Window	3.5292	North	1.0	1.21
D1, Half Glazed Door	2.142	West	N/A	1.21
R2, Roof Window	0.35	West	1.0	1.21
R2, Roof Window	0.35	West	1.0	1.21
W5, Window	0.483	West	1.0	1.21
W6, Window	1.092	West	1.0	1.21
W7, Window	1.035	West	1.0	1.21
W7, Window	1.035	West	1.0	1.21
W8, Window	0.9555	West	1.0	1.21
W9, Window	0.7245	West	1.0	1.21
W9, Window	0.7245	West	1.0	1.21
R1, Roof Window	0.792	South	1.0	1.21
R1, Roof Window	0.792	South	1.0	1.21
R1, Roof Window	0.792	South	1.0	1.21
R1, Roof Window	0.792	South	1.0	1.21
W10, Window	6.174	South	1.0	1.21
W10, Window	6.174	South	1.0	1.21
W11, Window	7.119	South	1.0	1.21
W12, Window	3.8352	South	1.0	1.21
W13, Window	2.35	South	1.0	1.21
W14, Window	11.2887	South	1.0	1.21
R3, Roof Window	0.55	East	1.0	1.21
R3, Roof Window	0.55	East	1.0	1.21
W5, Window	0.483	East	1.0	1.21
W7, Window	1.035	East	1.0	1.21
W7, Window	1.035	East	1.0	1.21
W9, Window	0.7245	East	1.0	1.21
W9, Window	0.7245	East	1.0	1.21
W9, Window	0.7245	East	1.0	1.21
W15, Window	0.828	East	1.0	1.21
W15, Window	0.828	East	1.0	1.21

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

Building part **1**: 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	0.02 **(!)**	RCD
External wall	E3: Sill	Calculated by person with suitable expertise	0.023 **(!)**	RCD
External wall	E4: Jamb	Calculated by person with suitable expertise	0.018 **(!)**	RCD
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.051	RCD
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	RCD
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.04	RCD
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R8: Roof to wall (rafter)	SAP table default	0.12	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.082	RCD
External wall	E14: Flat roof	SAP table default	0.16	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.039 **(!)**	RCD
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.018 **(!)**	RCD
Roof	R6: Flat ceiling	SAP table default	0.12	

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	88.9%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Ideal Boilers
Model	LOGIC MAX SYSTEM2
Commissioning	
Secondary heating system: N/A	
Fuel	Wood logs
Efficiency	81.0%
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	300 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	73.8%
Manufacturer	Q-Blue B.V.
Model	Blue QB1-21D

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	94 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	3.15 kWp
Orientation	East
Pitch	45°
Overshading	None or very little
Manufacturer	
MCS certificate	

Technology type: **Photovoltaic system (2)**	
Peak power	4.05 kWp
Orientation	South
Pitch	30°
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

Plot Reference	401 Wilbraham Road	Issued on Date	07/04/2026
Assessment Reference	401 Wilbraham Road	Plot Type Ref	
Plot Address	401, Wilbraham Road, Manchester, M21 0UT	SAP Version	10.2

SAP Rating	95 A	DER	7.04	TER	7.63
Environmental	92 A	% DER < TER			7.73
CO_2 Emissions (t/year)	2.59	DFEE	37.65	TFEE	41.32
Compliance Check	See BREL	% DFEE < TFEE			8.88
% DPER < TPER	2.14	DPER	39.89	TPER	40.76

Assessor Details	Mr. Daniel Crew	Assessor ID	AT06-0001
Client	., Omar Fiaz		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800	(1b)	x 2.6700	(2b) =	484.0176	(1b) - (3b)
First floor	156.5300	(1c)	x 3.0000	(2c) =	469.5900	(1c) - (3c)
Second floor	78.0600	(1d)	x 2.7700	(2d) =	216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		1169.8338	(5)

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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	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.0684 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2684 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2684 (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	0.3422	0.3355	0.3288	0.2952	0.2885	0.2550	0.2550	0.2483	0.2684	0.2885	0.3019	0.3154	(22b)
Effective ac	0.5585	0.5563	0.5540	0.5436	0.5416	0.5325	0.5325	0.5308	0.5360	0.5416	0.5456	0.5497	(25)

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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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)
Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 69649.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.4800 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0200	0.7556
E3 Sill	22.0600	0.0230	0.5074
E4 Jamb	99.8400	0.0180	1.7971
E5 Ground floor (normal)	57.8000	0.0510	2.9478
E6 Intermediate floor within a dwelling	90.4100	0.0010	0.0904
E16 Corner (normal)	38.2400	0.0400	1.5296
R1 Head of roof window	7.0400	0.2400	1.6896
R2 Sill of roof window	7.0400	0.2400	1.6896
R3 Jamb of roof window	22.6000	0.2400	5.4240
R8 Roof to wall (rafter)	36.2100	0.1200	4.3452
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365
E14 Flat roof	15.3500	0.1600	2.4560
E13 Gable (insulation at rafter level)	7.7000	0.0390	0.3003
E11 Eaves (insulation at rafter level)	49.8000	0.0180	0.8964
R6 Flat ceiling	24.2900	0.1200	2.9148

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.3073 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 216.9545 (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	215.6246	214.7469	213.8867	209.8459	209.0899	205.5706	205.5706	204.9188	206.9262	209.0899	210.6193	212.2182	(38)
Heat transfer coeff	432.5791	431.7014	430.8411	426.8004	426.0444	422.5250	422.5250	421.8733	423.8806	426.0444	427.5738	429.1727	(39)

Average = Sum(39)m / 12 = 426.7968

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0402	1.0381	1.0360	1.0263	1.0245	1.0160	1.0160	1.0144	1.0193	1.0245	1.0281	1.0320	(40)
HLP (average)												1.0263	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.2826 (42)
Hot water usage for mixer showers

89.1649	87.8249	85.8723	82.1364	79.3793	76.3047	74.5571	76.4949	78.6191	81.9203	85.7365	88.8233	(42a)

Hot water usage for baths

34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)

Hot water usage for other uses

48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 157.7826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	171.6182	168.0158	163.5934	156.7840	151.2848	145.3605	143.0213	147.4240	152.0761	158.3037	165.2205	171.1610	(44)
Energy conte	271.8013	239.2523	251.4370	214.6294	203.6584	178.7377	172.9719	182.5417	187.5251	214.8166	235.3869	267.9967	(45)
Energy content (annual)										Total = Sum(45)m =		2620.7550	

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

40.7702	35.8878	37.7155	32.1944	30.5488	26.8107	25.9458	27.3813	28.1288	32.2225	35.3080	40.1995	(46)

Water storage loss (or HIU loss):
Store volume 300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.8900 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0206 (55)
Total storage loss

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)

If cylinder contains dedicated solar storage

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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)

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

326.7023	288.8403	306.3380	267.7594	258.5594	231.8677	227.8729	237.4427	240.6551	269.7176	288.5169	322.8977	(62)
-80.6639	-71.3399	-74.7030	-61.8570	-57.6485	-49.3302	-46.2392	-49.1708	-51.0390	-60.1693	-68.1645	-79.1702	(63a)
-40.4046	-88.4910	-185.9957	-205.9024	-200.9109	-182.5375	-181.6337	-188.2719	-189.6161	-129.4927	-54.6557	-31.5916	(63b)
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)
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)

PV diverter
Solar input
FGHRS
Output from w/h

205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359	(64)
									Total per year (kWh/year) = Sum(64)m =		838.1707	(64)

12Total per year (kWh/year) 838 (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

134.2947	119.2218	127.5236	113.8683	111.6372	101.9343	101.4340	104.6159	104.8561	115.3473	120.7701	133.0297	(65)

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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)m	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	280.7987	310.8843	280.7987	290.1587	280.7987	290.1587	280.7987	280.7987	290.1587	280.7987	290.1587	280.7987	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	546.5058	552.1768	537.8861	507.4627	469.0586	432.9642	408.8509	403.1799	417.4707	447.8941	486.2981	522.3925	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	(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)	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)	180.5037	177.4134	171.4027	158.1504	150.0500	141.5754	136.3360	140.6128	145.6334	155.0367	167.7363	178.8034	(72)
Total internal gains	1083.0467	1115.7129	1065.3259	1031.0101	975.1458	936.9367	898.2240	896.8298	925.5012	958.9679	1019.4315	1057.2331	(73)

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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	
North	17.8900	10.6334	0.4900	0.0000	0.7700	71.7743	(74)
East	6.3800	19.6403	0.4900	0.0000	0.7700	47.2775	(76)
South	36.9500	46.7521	0.4900	0.0000	0.7700	651.7815	(78)
West	6.0500	19.6403	0.4900	0.0000	0.7700	44.8321	(80)
North	2.3800	16.1759	0.4900	0.0000	1.0000	18.8643	(82)
East	1.1000	25.5349	0.4900	0.0000	1.0000	13.7633	(82)
South	3.1700	43.9921	0.4900	0.0000	1.0000	68.3329	(82)
West	0.7000	25.5349	0.4900	0.0000	1.0000	8.7585	(82)

Solar gains	925.3845	1590.1328	2219.1532	2833.3499	3257.8558	3273.4621	3139.5132	2815.4368	2429.9661	1768.5125	1110.7604	790.4944	(83)
Total gains	2008.4311	2705.8458	3284.4790	3864.3600	4233.0015	4210.3988	4037.7373	3712.2666	3355.4673	2727.4804	2130.1919	1847.7275	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.7252	44.8162	44.9056	45.3308	45.4112	45.7895	45.7895	45.8602	45.6430	45.4112	45.2488	45.0802	
alpha	3.9817	3.9877	3.9937	4.0221	4.0274	4.0526	4.0526	4.0573	4.0429	4.0274	4.0166	4.0053	
util living area	0.9956	0.9857	0.9621	0.8977	0.7738	0.5995	0.4495	0.5041	0.7432	0.9403	0.9895	0.9968	(86)
MIT	19.5178	19.7704	20.0918	20.4659	20.7379	20.8751	20.9119	20.9051	20.8071	20.4196	19.8888	19.4766	(87)
Th 2	20.0500	20.0517	20.0534	20.0615	20.0630	20.0700	20.0700	20.0713	20.0673	20.0630	20.0599	20.0568	(88)
util rest of house	0.9945	0.9824	0.9534	0.8749	0.7269	0.5260	0.3593	0.4101	0.6759	0.9220	0.9867	0.9961	(89)
MIT 2	18.2891	18.6121	19.0190	19.4842	19.7962	19.9388	19.9669	19.9645	19.8786	19.4392	18.7710	18.2414	(90)
Living area fraction									fLA = Living area / (4) =			0.1867	(91)
MIT	18.5185	18.8284	19.2193	19.6674	19.9720	20.1136	20.1433	20.1401	20.0519	19.6222	18.9797	18.4720	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3685	18.6784	19.0693	19.5174	19.8220	19.9636	19.9933	19.9901	19.9019	19.4722	18.8297	18.3220	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9760	0.9418	0.8591	0.7134	0.5171	0.3516	0.4016	0.6625	0.9072	0.9813	0.9940	(94)
Useful gains	1992.0761	2640.7904	3093.3030	3319.8033	3019.9541	2177.3411	1419.7452	1490.7121	2222.9650	2474.3825	2090.3298	1836.6734	(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	6085.7282	5948.1337	5415.3660	4531.5289	3460.3302	2266.2420	1433.7399	1514.5669	2459.3198	3779.9636	5015.3092	6060.7806	(97)
Space heating kWh	3045.6772	2222.5347	1727.6149	872.4424	327.6398	0.0000	0.0000	0.0000	0.0000	971.3524	2105.9852	3142.7357	(98a)
Space heating requirement - total per year (kWh/year)												14415.9823	
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	3045.6772	2222.5347	1727.6149	872.4424	327.6398	0.0000	0.0000	0.0000	0.0000	971.3524	2105.9852	3142.7357	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14415.9823	
Space heating per m2											(98c) / (4) =	34.6646	(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	3971.7353	3126.6852	3206.2371	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9152	0.8875	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3415.7320	2861.4798	2845.4387	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4653.0339	4463.4653	4106.1175	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	890.8574	1191.8772	937.9451	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.1948	(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	43.3786	58.0362	45.6715	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												147.0863	(107)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	81.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.6000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3045.6772	2222.5347	1727.6149	872.4424	327.6398	0.0000	0.0000	0.0000	0.0000	971.3524	2105.9852	3142.7357	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	3083.3627	2250.0352	1748.9915	883.2376	331.6938	0.0000	0.0000	0.0000	0.0000	983.3714	2132.0435	3181.6222	(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)	376.0095	274.3870	213.2858	107.7089	40.4494	0.0000	0.0000	0.0000	0.0000	119.9200	259.9982	387.9921	(215)

Water heating

Water heating requirement

	205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359 (64)
Efficiency of water heater												79.9000 (216)
(217)m	88.2067	88.2974	88.6154	88.9000	88.9000	79.9000	79.9000	79.9000	79.9000	88.0678	88.1022	88.2068 (217)
Fuel for water heating, kWh/month												
	233.1273	146.1079	51.5026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.9022	188.0733	240.4983 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	7.7462	10.3636	8.1556	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	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	63.7560	51.1475	46.0526	33.7401	26.0618	21.2927	23.7745	30.9030	40.1399	52.6657	59.4858	65.5280 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-93.9210	-134.1947	-195.6288	-220.5703	-235.9560	-218.8646	-215.4167	-203.9336	-182.8038	-153.3614	-103.4263	-80.7315 (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	-11.2235	-24.5808	-51.6655	-179.4596	-333.2312	-363.2481	-354.8916	-251.5035	-112.6396	-35.9702	-15.1821	-8.7755 (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	14594.3578 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	1779.7509 (215)
Efficiency of water heater	79.9000
Water heating fuel used	950.2117 (219)
Space cooling fuel	26.2654 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	514.5476 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3781.1799 (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	14169.9535 (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	14594.3578	0.2100	3064.8151	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	1779.7509	0.0280	49.8330	(263)
Water heating (other fuel)	950.2117	0.2100	199.5445	(264)
Space and water heating			3314.1926	(265)
Space cooling	26.2654	0.1140	2.9933	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	514.5476	0.1443	74.2651	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	0.1346	-274.3506	
PV Unit electricity exported	-1742.3712	0.1162	-202.5487	
Total			-476.8993	(269)
Total CO2, kg/year			2926.4810	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.0400	(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	14594.3578	1.1300	16491.6243	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1779.7509	1.0460	1861.6194	(277)
Water heating (other fuel)	950.2117	1.1300	1073.7392	(278)
Space and water heating			19426.9829	(279)
Space cooling	26.2654	1.4201	37.2988	(280)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	514.5476	1.5338	789.2303	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	1.4973	-3052.7681	
PV Unit electricity exported	-1742.3712	0.4260	-742.2739	
Total			-3795.0420	(283)
Total Primary energy kWh/year			16588.5709	(286)
Dwelling Primary energy Rate (DPER)			39.8900	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800 (1b)	x	2.6700 (2b)	=	484.0176 (1b) - (3b)	
First floor	156.5300 (1c)	x	3.0000 (2c)	=	469.5900 (1c) - (3c)	
Second floor	78.0600 (1d)	x	2.7700 (2d)	=	216.2262 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	1169.8338	(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) =	0.0342 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2842 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2842 (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	0.3623	0.3552	0.3481	0.3126	0.3055	0.2700	0.2700	0.2629	0.2842	0.3055	0.3197	0.3339	(22b)
Effective ac	0.5656	0.5631	0.5606	0.5489	0.5467	0.5364	0.5364	0.5346	0.5404	0.5467	0.5511	0.5558	(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	
Main dwelling								
TER Semi-glazed door			2.1400	1.0000	2.1400			(26a)
TER Opening Type			67.2700	1.1450	77.0267			(27)
TER Roof Window			7.3500	1.1450	10.8930			(27a)
Ground Floor			181.2800	0.1300	23.5664			(28a)
External Wall	311.7400	69.4100	242.3300	0.1800	43.6194			(29a)
Stud Wall	66.1900		66.1900	0.1800	11.9142			(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1100	16.0864			(30)
Flat Roof	53.5700		53.5700	0.1100	5.8927			(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		191.1389			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			167.4800 (35)
List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0500	1.8890
E3 Sill	22.0600	0.0500	1.1030
E4 Jamb	99.8400	0.0500	4.9920
E5 Ground floor (normal)	57.8000	0.1600	9.2480
E6 Intermediate floor within a dwelling	90.4100	0.0000	0.0000
E16 Corner (normal)	38.2400	0.0900	3.4416
R1 Head of roof window	7.0400	0.0800	0.5632
R2 Sill of roof window	7.0400	0.0600	0.4224
R3 Jamb of roof window	22.6000	0.0800	1.8080
R8 Roof to wall (rafter)	36.2100	0.0600	2.1726
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0900	-1.1376
E14 Flat roof	15.3500	0.0800	1.2280
E13 Gable (insulation at rafter level)	7.7000	0.0800	0.6160
E11 Eaves (insulation at rafter level)	49.8000	0.0400	1.9920
R6 Flat ceiling	24.2900	0.0600	1.4574
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			29.7956 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	220.9345 (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	218.3654	217.3813	216.4167	211.8860	211.0383	207.0922	207.0922	206.3614	208.6122	211.0383	212.7531	214.5459	(38)
Heat transfer coeff	439.2998	438.3158	437.3511	432.8204	431.9727	428.0266	428.0266	427.2959	429.5466	431.9727	433.6876	435.4804	(39)
Average = Sum(39)m / 12 =												432.8164	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0563	1.0540	1.0517	1.0408	1.0387	1.0292	1.0292	1.0275	1.0329	1.0387	1.0428	1.0472	(40)
HLP (average)												1.0407	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy											3.2826	(42)
Hot water usage for mixer showers	79.2577	78.0666	76.3310	73.0101	70.5594	67.8264	66.2730	67.9955	69.8837	72.8181	76.2103	78.9540	(42a)
Hot water usage for baths	34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)
Hot water usage for other uses	48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 148.6485 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	161.7110	158.2575	154.0520	147.6577	142.4649	136.8822	134.7372	138.9246	143.3407	149.2014	155.6942	161.2917	(44)
Energy conte	256.1107	225.3566	236.7722	202.1360	191.7851	168.3127	162.9530	172.0176	176.7534	202.4649	221.8150	252.5439	(45)
Energy content (annual)										Total = Sum(45)m =		2469.0210	
Distribution loss (46)m = 0.15 x (45)m													
	38.4166	33.8035	35.5158	30.3204	28.7678	25.2469	24.4429	25.8026	26.5130	30.3697	33.2722	37.8816	(46)
Water storage loss (or HIU loss):													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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													
	314.7396	278.3116	295.4010	258.8736	250.4139	225.0502	221.5818	230.6464	233.4909	261.0937	278.5525	311.1727	(62)
WWHRS	-36.2333	-32.0450	-33.5557	-27.7855	-25.8951	-22.1586	-20.7701	-22.0870	-22.9261	-27.0274	-30.6187	-35.5623	(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													
	278.5062	246.2666	261.8453	231.0881	224.5189	202.8917	200.8117	208.5595	210.5648	234.0663	247.9338	275.6103	(64)
										Total per year (kWh/year) = Sum(64)m =		2822.6633	(64)
12Total per year (kWh/year)												2823	(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													
	132.0599	117.2951	125.6298	112.6003	110.6716	101.3540	101.0849	104.0989	104.1605	114.2226	119.1435	130.8739	(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	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	280.7987	310.8843	280.7987	290.1587	280.7987	290.1587	280.7987	280.7987	290.1587	280.7987	290.1587	280.7987	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	546.5058	552.1768	537.8861	507.4627	469.0586	432.9642	408.8509	403.1799	417.4707	447.8941	486.2981	522.3925	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	(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)													
	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)													
	177.4998	174.5463	168.8573	156.3893	148.7521	140.7695	135.8668	139.9179	144.6674	153.5250	165.4771	175.9058	(72)
Total internal gains													
	1080.0428	1112.8459	1062.7805	1029.2490	973.8479	936.1307	897.7549	896.1349	924.5352	957.4562	1017.1724	1054.3354	(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	
North	17.8900	10.6334	0.6300	0.7000	0.7700	58.1372	(74)
East	6.3800	19.6403	0.6300	0.7000	0.7700	38.2948	(76)
South	36.9500	46.7521	0.6300	0.7000	0.7700	527.9430	(78)
West	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140	(80)
North	2.3800	16.1759	0.6300	0.7000	1.0000	15.2801	(82)
East	1.1000	25.5349	0.6300	0.7000	1.0000	11.1483	(82)
South	3.1700	43.9921	0.6300	0.7000	1.0000	55.3496	(82)
West	0.7000	25.5349	0.6300	0.7000	1.0000	7.0944	(82)

Solar gains	749.5614	1288.0076	1797.5141	2295.0134	2638.8632	2651.5043	2543.0057	2280.5038	1968.2725	1432.4951	899.7159	640.3005	(83)
Total gains	1829.6042	2400.8535	2860.2945	3324.2624	3612.7111	3587.6350	3440.7606	3176.6387	2892.8077	2389.9513	1916.8882	1694.6359	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.0410	44.1399	44.2372	44.7003	44.7880	45.2009	45.2009	45.2782	45.0410	44.7880	44.6109	44.4273	
alpha	3.9361	3.9427	3.9491	3.9800	3.9859	4.0134	4.0134	4.0185	4.0027	3.9859	3.9741	3.9618	
util living area													
	0.9968	0.9906	0.9759	0.9332	0.8395	0.6811	0.5242	0.5811	0.8097	0.9605	0.9928	0.9977	(86)
MIT	19.0319	19.3286	19.7310	20.2348	20.6469	20.8936	20.9713	20.9570	20.7768	20.2121	19.5222	18.9870	(87)
Th 2	20.0366	20.0386	20.0405	20.0495	20.0512	20.0590	20.0590	20.0605	20.0560	20.0512	20.0478	20.0442	(88)
util rest of house													
	0.9961	0.9883	0.9700	0.9163	0.7989	0.6053	0.4219	0.4775	0.7482	0.9473	0.9908	0.9971	(89)
MIT 2	17.7045	18.0846	18.5969	19.2310	19.7192	19.9829	20.0457	20.0386	19.8745	19.2143	18.3395	17.6518	(90)
Living area fraction										fLA = Living area / (4) =		0.1867	(91)
MIT	17.9523	18.3168	18.8086	19.4184	19.8924	20.1529	20.2185	20.2101	20.0429	19.4006	18.5603	17.9011	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9523	18.3168	18.8086	19.4184	19.8924	20.1529	20.2185	20.2101	20.0429	19.4006	18.5603	17.9011	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9825	0.9597	0.9024	0.7911	0.6134	0.4399	0.4949	0.7472	0.9352	0.9859	0.9951	(94)

Useful gains	1817.6899	2358.8058	2744.9102	2999.9298	2858.0037	2200.7853	1513.5583	1571.9843	2161.6155	2235.1093	1889.9459	1686.3354	(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	5997.4514	5880.8152	5383.1679	4552.5813	3538.8855	2376.8047	1548.7937	1628.0187	2552.7526	3801.6040	4970.1948	5966.5411	(97)
Space heating kWh	3109.7425	2366.7903	1962.8637	1117.9090	506.5760	0.0000	0.0000	0.0000	0.0000	1165.4720	2217.7792	3184.4731	(98a)
Space heating requirement - total per year (kWh/year)												15631.6058	
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	3109.7425	2366.7903	1962.8637	1117.9090	506.5760	0.0000	0.0000	0.0000	0.0000	1165.4720	2217.7792	3184.4731	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15631.6058	
Space heating per m2											(98c) / (4) =	37.5877	(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 %)												92.3000	(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	3109.7425	2366.7903	1962.8637	1117.9090	506.5760	0.0000	0.0000	0.0000	0.0000	1165.4720	2217.7792	3184.4731	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	3369.1685	2564.2365	2126.6129	1211.1690	548.8365	0.0000	0.0000	0.0000	0.0000	1262.6999	2402.7944	3450.1333	(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	278.5062	246.2666	261.8453	231.0881	224.5189	202.8917	200.8117	208.5595	210.5648	234.0663	247.9338	275.6103	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.9843	87.8661	87.6367	87.1169	85.8273	79.8000	79.8000	79.8000	79.8000	87.1560	87.8043	88.0094	(217)
Fuel for water heating, kWh/month	316.5407	280.2750	298.7851	265.2621	261.5936	254.2502	251.6437	261.3527	263.8657	268.5601	282.3711	313.1603	(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	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	58.3444	46.8061	42.1437	30.8763	23.8497	19.4854	21.7565	28.2799	36.7328	48.1955	54.4367	59.9660	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-141.4398	-186.6130	-251.0155	-263.1918	-268.2520	-244.4252	-240.7183	-234.1474	-221.3531	-203.0911	-150.5444	-123.7722	(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	-123.9899	-254.0869	-493.3910	-725.1522	-944.3924	-944.2880	-933.7746	-797.6586	-593.7877	-358.6369	-163.8597	-98.6366	(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												16935.6509	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3317.6601	(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)												470.8730	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-8960.2182	(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												11849.9658	(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	16935.6509	0.2100	3556.4867	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3317.6601	0.2100	696.7086	(264)
Space and water heating			4253.1953	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	470.8730	0.1443	67.9615	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2528.5639	0.1361	-344.1716	
PV Unit electricity exported	-6431.6543	0.1265	-813.8131	
Total			-1157.9848	(269)
Total CO2, kg/year			3175.1013	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.6300	(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	16935.6509	1.1300	19137.2855	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3317.6601	1.1300	3748.9559	(278)
Space and water heating			22886.2415	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	470.8730	1.5338	722.2407	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2528.5639	1.5031	-3800.7759	
PV Unit electricity exported	-6431.6543	0.4645	-2987.4267	
Total			-6788.2025	(283)
Total Primary energy kWh/year			16950.3804	(286)
Target Primary Energy Rate (TPER)			40.7600	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800 (1b)	x	2.6700 (2b)	=	484.0176	(1b) - (3b)
First floor	156.5300 (1c)	x	3.0000 (2c)	=	469.5900	(1c) - (3c)
Second floor	78.0600 (1d)	x	2.7700 (2d)	=	216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	1169.8338	(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) =	0.0342	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2342	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2342	(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	0.2986	0.2927	0.2869	0.2576	0.2518	0.2225	0.2225	0.2166	0.2342	0.2518	0.2635	0.2752	(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	0.5446	0.5428	0.5412	0.5332	0.5317	0.5247	0.5247	0.5235	0.5274	0.5317	0.5347	0.5379	(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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)
Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		69649.9100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							167.4800	(35)
List of Thermal Bridges								

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	37.7800	0.0200	0.7556	
E3 Sill	22.0600	0.0230	0.5074	
E4 Jamb	99.8400	0.0180	1.7971	
E5 Ground floor (normal)	57.8000	0.0510	2.9478	
E6 Intermediate floor within a dwelling	90.4100	0.0010	0.0904	
E16 Corner (normal)	38.2400	0.0400	1.5296	
R1 Head of roof window	7.0400	0.2400	1.6896	
R2 Sill of roof window	7.0400	0.2400	1.6896	
R3 Jamb of roof window	22.6000	0.2400	5.4240	
R8 Roof to wall (rafter)	36.2100	0.1200	4.3452	
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365	
E14 Flat roof	15.3500	0.1600	2.4560	
E13 Gable (insulation at rafter level)	7.7000	0.0390	0.3003	
E11 Eaves (insulation at rafter level)	49.8000	0.0180	0.8964	
R6 Flat ceiling	24.2900	0.1200	2.9148	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.3073 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 216.9545 (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	210.2324	209.5641	208.9091	205.8323	205.2567	202.5770	202.5770	202.0807	203.6092	205.2567	206.4212	207.6387	(38)
Heat transfer coeff	427.1868	426.5186	425.8635	422.7868	422.2111	419.5314	419.5314	419.0352	420.5636	422.2111	423.3757	424.5931	(39)

Average = Sum(39)m / 12 = 422.7840

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0272	1.0256	1.0240	1.0166	1.0152	1.0088	1.0088	1.0076	1.0113	1.0152	1.0180	1.0210	(40)
HLP (average)												1.0166	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.2826 (42)

Hot water usage for mixer showers

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

34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)

Hot water usage for other uses

48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 75.5756 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.4533	80.1909	77.7211	74.6476	71.9055	69.0558	68.4643	70.9291	73.4570	76.3833	79.4840	82.3377	(44)
Energy conte	130.5859	114.1908	119.4544	102.1888	96.7986	84.9122	82.8016	87.8250	90.5798	103.6514	113.2395	128.9209	(45)

Energy content (annual) Total = Sum(45)m = 1255.1490

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 (or HIU 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 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

110.9980	97.0621	101.5362	86.8605	82.2788	72.1754	70.3814	74.6513	76.9929	88.1037	96.2536	109.5828	(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

110.9980	97.0621	101.5362	86.8605	82.2788	72.1754	70.3814	74.6513	76.9929	88.1037	96.2536	109.5828	(64)

Total per year (kWh/year) = Sum(64)m = 1066.8766 (64)

12Total per year (kWh/year) 1067 (64)

Electric shower(s)

63.4722	56.5543	61.7551	58.9321	60.0380	57.2704	59.1794	60.0380	58.9321	61.7551	60.5939	63.4722	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 721.9927 (64a)

Heat gains from water heating, kWh/month

43.6176	38.4041	40.8228	36.4482	35.5792	32.3614	32.3902	33.6723	33.9812	37.4647	39.2119	43.2637	(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	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	280.7987	310.8843	280.7987	290.1587	280.7987	290.1587	280.7987	280.7987	290.1587	280.7987	290.1587	280.7987	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	546.5058	552.1768	537.8861	507.4627	469.0586	432.9642	408.8509	403.1799	417.4707	447.8941	486.2981	522.3925	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	(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)	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)	58.6258	57.1490	54.8694	50.6224	47.8215	44.9464	43.5352	45.2585	47.1962	50.3558	54.4609	58.1502	(72)
Total internal gains	958.1687	992.4485	945.7926	920.4822	869.9172	840.3077	805.4232	801.4755	827.0639	851.2870	903.1561	933.5799	(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	
North	17.8900	10.6334	0.4900	0.0000	0.7700	71.7743	(74)
East	6.3800	19.6403	0.4900	0.0000	0.7700	47.2775	(76)
South	36.9500	46.7521	0.4900	0.0000	0.7700	651.7815	(78)

West				6.0500	19.6403	0.4900	0.0000	0.7700				44.8321	(80)
North				2.3800	16.1759	0.4900	0.0000	1.0000				18.8643	(82)
East				1.1000	25.5349	0.4900	0.0000	1.0000				13.7633	(82)
South				3.1700	43.9921	0.4900	0.0000	1.0000				68.3329	(82)
West				0.7000	25.5349	0.4900	0.0000	1.0000				8.7585	(82)
Solar gains	925.3845	1590.1328	2219.1532	2833.3499	3257.8558	3273.4621	3139.5132	2815.4368	2429.9661	1768.5125	1110.7604	790.4944	(83)
Total gains	1883.5532	2582.5814	3164.9458	3753.8321	4127.7730	4113.7698	3944.9365	3616.9122	3257.0300	2619.7994	2013.9165	1724.0743	(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	45.2898	45.3607	45.4305	45.7611	45.8235	46.1162	46.1162	46.1708	46.0030	45.8235	45.6975	45.5664	
alpha	4.0193	4.0240	4.0287	4.0507	4.0549	4.0744	4.0744	4.0781	4.0669	4.0549	4.0465	4.0378	
util living area	0.9965	0.9877	0.9658	0.9039	0.7816	0.6077	0.4564	0.5130	0.7538	0.9464	0.9914	0.9975	(86)
MIT	19.1093	19.4470	19.8776	20.3788	20.7474	20.9331	20.9836	20.9739	20.8387	20.3103	19.5982	19.0500	(87)
Th 2	20.0607	20.0621	20.0634	20.0695	20.0706	20.0760	20.0760	20.0770	20.0739	20.0706	20.0683	20.0659	(88)
util rest of house	0.9957	0.9849	0.9579	0.8821	0.7356	0.5342	0.3656	0.4184	0.6875	0.9296	0.9890	0.9970	(89)
MIT 2	18.3137	18.6504	19.0755	19.5606	19.8910	20.0400	20.0702	20.0670	19.9753	19.5067	18.8070	18.2584	(90)
Living area fraction									fLA = Living area / (4) =			0.1867	(91)
MIT	18.4622	18.7991	19.2252	19.7133	20.0509	20.2067	20.2407	20.2363	20.1364	19.6567	18.9547	18.4061	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4622	18.7991	19.2252	19.7133	20.0509	20.2067	20.2407	20.2363	20.1364	19.6567	18.9547	18.4061	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9798	0.9489	0.8723	0.7345	0.5451	0.3822	0.4353	0.6924	0.9203	0.9850	0.9954	(94)
Useful gains	1871.6036	2530.3205	3003.3141	3274.4840	3031.7649	2242.4805	1507.6290	1574.2960	2255.2491	2410.8951	1983.6551	1716.2212	(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	6049.9185	5928.2362	5419.2084	4571.7226	3525.8269	2352.1878	1527.3893	1607.5489	2538.7109	3823.8510	5019.0035	6031.8239	(97)
Space heating kWh	3108.6663	2283.3993	1797.4253	934.0118	367.5821	0.0000	0.0000	0.0000	0.0000	1051.2392	2185.4508	3210.8084	(98a)
Space heating requirement - total per year (kWh/year)												14938.5833	
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	3108.6663	2283.3993	1797.4253	934.0118	367.5821	0.0000	0.0000	0.0000	0.0000	1051.2392	2185.4508	3210.8084	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14938.5833	
Space heating per m2											(98c) / (4) =	35.9213	(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	3943.5953	3104.5325	3184.6673	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8562	0.9127	0.8834	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3376.6539	2833.4814	2813.3310	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4555.8365	4370.0502	4009.9648	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	849.0115	1143.2072	890.2955	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	212.2529	285.8018	222.5739	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												720.6285	(107)
Energy for space heating												35.9213	(99)
Energy for space cooling												1.7328	(108)
Total												37.6541	(109)
Fabric Energy Efficiency (DFEE)												37.7	(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)	
Main dwelling						
Ground floor	181.2800	(1b)	x 2.6700	(2b)	= 484.0176	(1b) - (3b)
First floor	156.5300	(1c)	x 3.0000	(2c)	= 469.5900	(1c) - (3c)
Second floor	78.0600	(1d)	x 2.7700	(2d)	= 216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		1169.8338	(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) =	0.0342	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2842	(18)
Number of sides sheltered	0	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2842	(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	0.3623	0.3552	0.3481	0.3126	0.3055	0.2700	0.2700	0.2629	0.2842	0.3055	0.3197	0.3339	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5656	0.5631	0.5606	0.5489	0.5467	0.5364	0.5364	0.5346	0.5404	0.5467	0.5511	0.5558	(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	
Main dwelling								
TER Semi-glazed door			2.1400	1.0000	2.1400			(26a)
TER Opening Type			67.2700	1.1450	77.0267			(27)
TER Roof Window			7.3500	1.1450	10.8930			(27a)
Ground Floor			181.2800	0.1300	23.5664			(28a)
External Wall	311.7400	69.4100	242.3300	0.1800	43.6194			(29a)
Stud Wall	66.1900		66.1900	0.1800	11.9142			(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1100	16.0864			(30)
Flat Roof	53.5700		53.5700	0.1100	5.8927			(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	191.1389			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.4800 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0500	1.8890
E3 Sill	22.0600	0.0500	1.1030
E4 Jamb	99.8400	0.0500	4.9920
E5 Ground floor (normal)	57.8000	0.1600	9.2480
E6 Intermediate floor within a dwelling	90.4100	0.0000	0.0000
E16 Corner (normal)	38.2400	0.0900	3.4416
R1 Head of roof window	7.0400	0.0800	0.5632
R2 Sill of roof window	7.0400	0.0600	0.4224
R3 Jamb of roof window	22.6000	0.0800	1.8080
R8 Roof to wall (rafter)	36.2100	0.0600	2.1726
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0900	-1.1376
E14 Flat roof	15.3500	0.0800	1.2280
E13 Gable (insulation at rafter level)	7.7000	0.0800	0.6160
E11 Eaves (insulation at rafter level)	49.8000	0.0400	1.9920
R6 Flat ceiling	24.2900	0.0600	1.4574

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	29.7956	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	220.9345	(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	218.3654	217.3813	216.4167	211.8860	211.0383	207.0922	207.0922	206.3614	208.6122	211.0383	212.7531	214.5459	(38)
Heat transfer coeff	439.2998	438.3158	437.3511	432.8204	431.9727	428.0266	428.0266	427.2959	429.5466	431.9727	433.6876	435.4804	(39)

Average = Sum(39)m / 12 = 432.8164

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0563	1.0540	1.0517	1.0408	1.0387	1.0292	1.0292	1.0275	1.0329	1.0387	1.0428	1.0472	(40)
HLP (average)												1.0407	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.2826 (42)

Hot water usage for mixer showers

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

34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)

Hot water usage for other uses

48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 75.5756 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.4533	80.1909	77.7211	74.6476	71.9055	69.0558	68.4643	70.9291	73.4570	76.3833	79.4840	82.3377	(44)
Energy conte	130.5859	114.1908	119.4544	102.1888	96.7986	84.9122	82.8016	87.8250	90.5798	103.6514	113.2395	128.9209	(45)

Energy content (annual) Total = Sum(45)m = 1255.1490

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 (or HIU 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	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

110.9980	97.0621	101.5362	86.8605	82.2788	72.1754	70.3814	74.6513	76.9929	88.1037	96.2536	109.5828	(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

110.9980	97.0621	101.5362	86.8605	82.2788	72.1754	70.3814	74.6513	76.9929	88.1037	96.2536	109.5828	(64)

Total per year (kWh/year) = Sum(64)m = 1066.8766 (64)

12Total per year (kWh/year) 1067 (64)

Electric shower(s)

63.4722	56.5543	61.7551	58.9321	60.0380	57.2704	59.1794	60.0380	58.9321	61.7551	60.5939	63.4722	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 721.9927 (64a)

Heat gains from water heating, kWh/month

43.6176	38.4041	40.8228	36.4482	35.5792	32.3614	32.3902	33.6723	33.9812	37.4647	39.2119	43.2637	(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	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	164.1281	(66)

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

280.7987	310.8843	280.7987	290.1587	280.7987	290.1587	280.7987	280.7987	290.1587	280.7987	290.1587	280.7987	(67)

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

546.5058	552.1768	537.8861	507.4627	469.0586	432.9642	408.8509	403.1799	417.4707	447.8941	486.2981	522.3925	(68)

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

39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	39.4128	(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)

-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)

Water heating gains (Table 5)

58.6258	57.1490	54.8694	50.6224	47.8215	44.9464	43.5352	45.2585	47.1962	50.3558	54.4609	58.1502	(72)

Total internal gains

958.1687	992.4485	945.7926	920.4822	869.9172	840.3077	805.4232	801.4755	827.0639	851.2870	903.1561	933.5799	(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	
North	17.8900	10.6334	0.6300	0.7000	0.7700	58.1372	(74)
East	6.3800	19.6403	0.6300	0.7000	0.7700	38.2948	(76)
South	36.9500	46.7521	0.6300	0.7000	0.7700	527.9430	(78)
West	6.0500	19.6403	0.6300	0.7000	0.7700	36.3140	(80)
North	2.3800	16.1759	0.6300	0.7000	1.0000	15.2801	(82)
East	1.1000	25.5349	0.6300	0.7000	1.0000	11.1483	(82)
South	3.1700	43.9921	0.6300	0.7000	1.0000	55.3496	(82)
West	0.7000	25.5349	0.6300	0.7000	1.0000	7.0944	(82)

Solar gains	749.5614	1288.0076	1797.5141	2295.0134	2638.8632	2651.5043	2543.0057	2280.5038	1968.2725	1432.4951	899.7159	640.3005	(83)
Total gains	1707.7302	2280.4561	2743.3067	3215.4956	3508.7804	3491.8120	3348.4290	3081.9793	2795.3365	2283.7821	1802.8720	1573.8804	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.0410	44.1399	44.2372	44.7003	44.7880	45.2009	45.2009	45.2782	45.0410	44.7880	44.6109	44.4273	
alpha	3.9361	3.9427	3.9491	3.9800	3.9859	4.0134	4.0134	4.0185	4.0027	3.9859	3.9741	3.9618	
util living area	0.9975	0.9921	0.9789	0.9393	0.8496	0.6938	0.5366	0.5954	0.8228	0.9657	0.9942	0.9982	(86)
MIT	18.9890	19.2873	19.6932	20.2054	20.6284	20.8862	20.9688	20.9531	20.7616	20.1798	19.4826	18.9442	(87)
Th 2	20.0366	20.0386	20.0405	20.0495	20.0512	20.0590	20.0590	20.0605	20.0560	20.0512	20.0478	20.0442	(88)
util rest of house	0.9969	0.9902	0.9737	0.9236	0.8104	0.6182	0.4327	0.4906	0.7632	0.9540	0.9925	0.9978	(89)
MIT 2	18.1764	18.4749	18.8786	19.3843	19.7772	19.9951	20.0476	20.0417	19.9034	19.3684	18.6772	18.1371	(90)

Living area fraction fLA = Living area / (4) = 0.1867 (91)

MIT	18.3281	18.6265	19.0306	19.5375	19.9361	20.1614	20.2196	20.2118	20.0636	19.5199	18.8276	18.2878	(92)

Temperature adjustment 0.0000

adjusted MIT	18.3281	18.6265	19.0306	19.5375	19.9361	20.1614	20.2196	20.2118	20.0636	19.5199	18.8276	18.2878	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9863	0.9664	0.9132	0.8049	0.6271	0.4512	0.5085	0.7638	0.9453	0.9895	0.9966	(94)
Useful gains	1699.8136	2249.2992	2651.2013	2936.4107	2824.3421	2189.6935	1510.7119	1567.0680	2134.9442	2158.9353	1783.8879	1568.5355	(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	6162.5260	6016.5546	5480.2824	4604.1462	3557.7595	2380.4379	1549.2811	1628.7877	2561.6404	3853.1349	5086.0945	6134.9425	(97)
Space heating kWh	3320.2580	2531.5956	2104.8364	1200.7695	545.6625	0.0000	0.0000	0.0000	0.0000	1260.4845	2377.5888	3397.4068	(98a)

Space heating requirement - total per year (kWh/year) 16738.6021

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

3320.2580	2531.5956	2104.8364	1200.7695	545.6625	0.0000	0.0000	0.0000	0.0000	1260.4845	2377.5888	3397.4068	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 16738.6021

Space heating per m2 (98c) / (4) = 40.2496 (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	4023.4503	3167.3971	3247.4486	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7825	0.8568	0.8188	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3148.2919	2713.8025	2659.0089	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3849.7059	3692.4887	3401.0511	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	505.0181	728.1425	552.0794	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	126.2545	182.0356	138.0199	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												446.3100	(107)
Energy for space heating												40.2496	(99)
Energy for space cooling												1.0732	(108)
Total												41.3228	(109)
Fabric Energy Efficiency (TFEE)												41.3	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800	(1b)	x 2.6700	(2b) =	484.0176	(1b) - (3b)
First floor	156.5300	(1c)	x 3.0000	(2c) =	469.5900	(1c) - (3c)
Second floor	78.0600	(1d)	x 2.7700	(2d) =	216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		1169.8338	(5)

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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	8 * 10 =	80.0000	(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) =	80.0000 / (5) =	0.0684	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2684	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2684	(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													
	0.3422	0.3355	0.3288	0.2952	0.2885	0.2550	0.2550	0.2483	0.2684	0.2885	0.3019	0.3154	(22b)
Effective ac	0.5585	0.5563	0.5540	0.5436	0.5416	0.5325	0.5325	0.5308	0.5360	0.5416	0.5456	0.5497	(25)

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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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)
Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 69649.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.4800 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	37.7800	0.0200	0.7556
E3	Sill	22.0600	0.0230	0.5074
E4	Jamb	99.8400	0.0180	1.7971
E5	Ground floor (normal)	57.8000	0.0510	2.9478
E6	Intermediate floor within a dwelling	90.4100	0.0010	0.0904
E16	Corner (normal)	38.2400	0.0400	1.5296
R1	Head of roof window	7.0400	0.2400	1.6896
R2	Sill of roof window	7.0400	0.2400	1.6896
R3	Jamb of roof window	22.6000	0.2400	5.4240
R8	Roof to wall (rafter)	36.2100	0.1200	4.3452
E17	Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365
E14	Flat roof	15.3500	0.1600	2.4560
E13	Gable (insulation at rafter level)	7.7000	0.0390	0.3003
E11	Eaves (insulation at rafter level)	49.8000	0.0180	0.8964
R6	Flat ceiling	24.2900	0.1200	2.9148

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 26.3073 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 216.9545 (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	215.6246	214.7469	213.8867	209.8459	209.0899	205.5706	205.5706	204.9188	206.9262	209.0899	210.6193	212.2182	(38)
Heat transfer coeff	432.5791	431.7014	430.8411	426.8004	426.0444	422.5250	422.5250	421.8733	423.8806	426.0444	427.5738	429.1727	(39)
Average = Sum(39)m / 12 =												426.7968	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0402	1.0381	1.0360	1.0263	1.0245	1.0160	1.0160	1.0144	1.0193	1.0245	1.0281	1.0320	(40)
HLP (average)												1.0263	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.2826 (42)
Hot water usage for mixer showers

89.1649	87.8249	85.8723	82.1364	79.3793	76.3047	74.5571	76.4949	78.6191	81.9203	85.7365	88.8233	(42a)

Hot water usage for baths

34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)

Hot water usage for other uses

48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 157.7826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	171.6182	168.0158	163.5934	156.7840	151.2848	145.3605	143.0213	147.4240	152.0761	158.3037	165.2205	171.1610	(44)
Energy conte	271.8013	239.2523	251.4370	214.6294	203.6584	178.7377	172.9719	182.5417	187.5251	214.8166	235.3869	267.9967	(45)
Energy content (annual)											Total = Sum(45)m =	2620.7550	

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

40.7702	35.8878	37.7155	32.1944	30.5488	26.8107	25.9458	27.3813	28.1288	32.2225	35.3080	40.1995	(46)

Water storage loss (or HIU loss):
Store volume 300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.8900 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0206 (55)
Total storage loss

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)

If cylinder contains dedicated solar storage

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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

326.7023	288.8403	306.3380	267.7594	258.5594	231.8677	227.8729	237.4427	240.6551	269.7176	288.5169	322.8977	(62)
WWHRS -80.6639	-71.3399	-74.7030	-61.8570	-57.6485	-49.3302	-46.2392	-49.1708	-51.0390	-60.1693	-68.1645	-79.1702	(63a)
PV diverter -40.4046	-88.4910	-185.9957	-205.9024	-200.9109	-182.5375	-181.6337	-188.2719	-189.6161	-129.4927	-54.6557	-31.5916	(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													
205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359	(64)
							Total per year (kWh/year) = Sum(64)m =				838.1707	(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

134.2947	119.2218	127.5236	113.8683	111.6372	101.9343	101.4340	104.6159	104.8561	115.3473	120.7701	133.0297	(65)

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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)m	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.8395	64.6954	52.6139	39.8321	29.7749	25.1373	27.1617	35.3058	47.3874	60.1692	70.2263	74.8640	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	815.6803	824.1445	802.8150	757.4070	700.0874	646.2152	610.2252	601.7610	623.0905	668.4986	725.8181	779.6904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	(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)	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)	180.5037	177.4134	171.4027	158.1504	150.0500	141.5754	136.3360	140.6128	145.6334	155.0367	167.7363	178.8034	(72)
Total internal gains	1195.6527	1192.8825	1153.4607	1082.0186	1006.5416	936.5570	897.3520	901.3087	939.7405	1010.3336	1090.4099	1159.9869	(73)

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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	
North	17.8900	10.6334	0.4900	0.0000	0.7700	71.7743	(74)
East	6.3800	19.6403	0.4900	0.0000	0.7700	47.2775	(76)
South	36.9500	46.7521	0.4900	0.0000	0.7700	651.7815	(78)
West	6.0500	19.6403	0.4900	0.0000	0.7700	44.8321	(80)
North	2.3800	16.1759	0.4900	0.0000	1.0000	18.8643	(82)
East	1.1000	25.5349	0.4900	0.0000	1.0000	13.7633	(82)
South	3.1700	43.9921	0.4900	0.0000	1.0000	68.3329	(82)
West	0.7000	25.5349	0.4900	0.0000	1.0000	8.7585	(82)

Solar gains	925.3845	1590.1328	2219.1532	2833.3499	3257.8558	3273.4621	3139.5132	2815.4368	2429.9661	1768.5125	1110.7604	790.4944	(83)
Total gains	2121.0372	2783.0154	3372.6139	3915.3684	4264.3973	4210.0191	4036.8653	3716.7455	3369.7066	2778.8461	2201.1702	1950.4813	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.7252	44.8162	44.9056	45.3308	45.4112	45.7895	45.7895	45.8602	45.6430	45.4112	45.2488	45.0802	
alpha	3.9817	3.9877	3.9937	4.0221	4.0274	4.0526	4.0526	4.0573	4.0429	4.0274	4.0166	4.0053	
util living area	0.9946	0.9842	0.9589	0.8943	0.7706	0.5995	0.4496	0.5036	0.7413	0.9370	0.9883	0.9961	(86)
MIT	19.5474	19.7898	20.1117	20.4746	20.7409	20.8751	20.9118	20.9052	20.8082	20.4302	19.9070	19.5038	(87)
Th 2	20.0500	20.0517	20.0534	20.0615	20.0630	20.0700	20.0700	20.0713	20.0673	20.0630	20.0599	20.0568	(88)
util rest of house	0.9934	0.9807	0.9496	0.8708	0.7235	0.5261	0.3594	0.4097	0.6739	0.9179	0.9851	0.9952	(89)
MIT 2	18.3269	18.6367	19.0436	19.4942	19.7991	19.9388	19.9669	19.9645	19.8796	19.4517	18.7941	18.2762	(90)
Living area fraction									fLA = Living area / (4) =			0.1867	(91)
MIT	18.5547	18.8519	19.2430	19.6772	19.9749	20.1136	20.1433	20.1401	20.0529	19.6343	19.0018	18.5054	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4047	18.7019	19.0930	19.5272	19.8249	19.9636	19.9933	19.9901	19.9029	19.4843	18.8518	18.3554	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9738	0.9375	0.8550	0.7102	0.5172	0.3517	0.4011	0.6606	0.9029	0.9793	0.9928	(94)
Useful gains	2100.3275	2710.1272	3161.8865	3347.8102	3028.4744	2177.3126	1419.7325	1490.8276	2225.8661	2508.9848	2155.5128	1936.4480	(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	6101.4103	5958.3027	5425.5695	4535.6893	3461.5741	2266.2378	1433.7378	1514.5854	2459.7493	3785.1236	5024.7696	6075.1119	(97)
Space heating kWh	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98a)
Space heating requirement - total per year (kWh/year)												14115.7369	
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	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14115.7369	
Space heating per m2											(98c) / (4) =	33.9427	(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	3971.7353	3126.6852	3206.2371	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9152	0.8875	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3415.7320	2861.4798	2845.4387	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4653.0339	4463.4653	4106.1175	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	890.8574	1191.8772	937.9451	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.1948	(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	43.3786	58.0362	45.6715	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												147.0863	(107)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	81.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.6000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	3013.6390	2209.7824	1705.0193	865.8556	326.2132	0.0000	0.0000	0.0000	0.0000	961.1952	2091.4268	3117.2659	(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)	367.5069	269.4783	207.9235	105.5893	39.7810	0.0000	0.0000	0.0000	0.0000	117.2157	255.0450	380.1439	(215)

Water heating

Water heating requirement

	205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359 (64)
Efficiency of water heater												79.9000 (216)
(217)m	88.1919	88.2872	88.6083	88.9000	88.9000	79.9000	79.9000	79.9000	79.9000	88.0504	88.0881	88.1936 (217)
Fuel for water heating, kWh/month												
	233.1664	146.1248	51.5068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.9201	188.1034	240.5343 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	7.7462	10.3636	8.1556	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	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	63.7560	51.1475	46.0526	33.7401	26.0618	21.2927	23.7745	30.9030	40.1399	52.6657	59.4858	65.5280 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-93.9210	-134.1947	-195.6288	-220.5703	-235.9560	-218.8646	-215.4167	-203.9336	-182.8038	-153.3614	-103.4263	-80.7315 (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	-11.2235	-24.5808	-51.6655	-179.4596	-333.2312	-363.2481	-354.8916	-251.5035	-112.6396	-35.9702	-15.1821	-8.7755 (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	14290.3973 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	1742.6836 (215)
Efficiency of water heater	79.9000
Water heating fuel used	950.3558 (219)
Space cooling fuel	26.2654 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	514.5476 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3781.1799 (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	13829.0697 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	14290.3973	3.6400	520.1705	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1742.6836	5.1200	89.2254	(242)
Water heating (other fuel)	950.3558	3.6400	34.5930	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Space cooling	26.2654	16.4900	4.3312	(248)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	514.5476	16.4900	84.8489	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	16.4900	-336.1996	
PV Unit electricity exported	-1742.3712	5.5900	-97.3986	
Total			-433.5981	(252)
Total energy cost			405.7522	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3169 (257)
SAP value		94.8623
SAP rating (Section 12)		95 (258)
SAP band		A

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	14290.3973	0.2100	3000.9834	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	1742.6836	0.0280	48.7951	(263)
Water heating (other fuel)	950.3558	0.2100	199.5747	(264)
Space and water heating			3249.3533	(265)
Space cooling	26.2654	0.1140	2.9933	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	514.5476	0.1443	74.2651	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	0.1346	-274.3506	
PV Unit electricity exported	-1742.3712	0.1162	-202.5487	
Total			-476.8993	(269)
Total CO2, kg/year			2861.6417	(272)
CO2 emissions per m2			6.8800	(273)
EI value			91.6796	
EI rating			92	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800 (1b)	x	2.6700 (2b)	=	484.0176 (1b) - (3b)	
First floor	156.5300 (1c)	x	3.0000 (2c)	=	469.5900 (1c) - (3c)	
Second floor	78.0600 (1d)	x	2.7700 (2d)	=	216.2262 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	1169.8338	(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	8 * 10 =	80.0000	(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) =	80.0000 / (5) =	0.0684	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2684	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2684	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000	(22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750	(22a)
Adj infilt rate	0.2885	0.2818	0.2818	0.2617	0.2684	0.2281	0.2214	0.2214	0.2281	0.2550	0.2550	0.2617	(22b)
Effective ac	0.5416	0.5397	0.5397	0.5342	0.5360	0.5260	0.5245	0.5245	0.5260	0.5325	0.5325	0.5342	(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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)
Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	69649.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		167.4800 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0200	0.7556
E3 Sill	22.0600	0.0230	0.5074
E4 Jamb	99.8400	0.0180	1.7971
E5 Ground floor (normal)	57.8000	0.0510	2.9478
E6 Intermediate floor within a dwelling	90.4100	0.0010	0.0904
E16 Corner (normal)	38.2400	0.0400	1.5296
R1 Head of roof window	7.0400	0.2400	1.6896
R2 Sill of roof window	7.0400	0.2400	1.6896
R3 Jamb of roof window	22.6000	0.2400	5.4240
R8 Roof to wall (rafter)	36.2100	0.1200	4.3452
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365
E14 Flat roof	15.3500	0.1600	2.4560
E13 Gable (insulation at rafter level)	7.7000	0.0390	0.3003
E11 Eaves (insulation at rafter level)	49.8000	0.0180	0.8964
R6 Flat ceiling	24.2900	0.1200	2.9148

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		26.3073	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	216.9545	(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	209.0899	208.3513	208.3513	206.2397	206.9262	203.0679	202.4857	202.4857	203.0679	205.5706	205.5706	206.2397	(38)
Heat transfer coeff													
	426.0444	425.3057	425.3057	423.1941	423.8806	420.0224	419.4402	419.4402	420.0224	422.5250	422.5250	423.1941	(39)
Average = Sum(39)m / 12 =												422.5750	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0227	1.0227	1.0176	1.0193	1.0100	1.0086	1.0086	1.0100	1.0160	1.0160	1.0176	(40)
HLP (average)												1.0161	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.2826	(42)
Hot water usage for mixer showers													
	89.1649	87.8249	85.8723	82.1364	79.3793	76.3047	74.5571	76.4949	78.6191	81.9203	85.7365	88.8233	(42a)
Hot water usage for baths													
	34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)
Hot water usage for other uses													
	48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)
Average daily hot water use (litres/day)												157.7826	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	171.6182	168.0158	163.5934	156.7840	151.2848	145.3605	143.0213	147.4240	152.0761	158.3037	165.2205	171.1610	(44)
Energy conte	271.8013	239.2523	251.4370	214.6294	203.6584	178.7377	172.9719	182.5417	187.5251	214.8166	235.3869	267.9967	(45)
Energy content (annual)										Total = Sum(45)m =		2620.7550	
Distribution loss (46)m = 0.15 x (45)m													
	40.7702	35.8878	37.7155	32.1944	30.5488	26.8107	25.9458	27.3813	28.1288	32.2225	35.3080	40.1995	(46)
Water storage loss (or HIU loss):													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0206	(55)
Total storage loss													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)
If cylinder contains dedicated solar storage													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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													
	326.7023	288.8403	306.3380	267.7594	258.5594	231.8677	227.8729	237.4427	240.6551	269.7176	288.5169	322.8977	(62)
WWHRS	-80.6639	-71.3399	-74.7030	-61.8570	-57.6485	-49.3302	-46.2392	-49.1708	-51.0390	-60.1693	-68.1645	-79.1702	(63a)
PV diverter	-33.9591	-77.3771	-173.0411	-205.9024	-200.9109	-182.5375	-181.6337	-188.2719	-189.6161	-121.5022	-47.8146	-27.3851	(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													
	212.0793	140.1233	58.5938	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	88.0461	172.5377	216.3425	(64)
										Total per year (kWh/year) = Sum(64)m =		887.7228	(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													
	134.2947	119.2218	127.5236	113.8683	111.6372	101.9343	101.4340	104.6159	104.8561	115.3473	120.7701	133.0297	(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	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	72.8395	64.6954	52.6139	39.8321	29.7749	25.1373	27.1617	35.3058	47.3874	60.1692	70.2263	74.8640	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	815.6803	824.1445	802.8150	757.4070	700.0874	646.2152	610.2252	601.7610	623.0905	668.4986	725.8181	779.6904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	(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)													
	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)													
	180.5037	177.4134	171.4027	158.1504	150.0500	141.5754	136.3360	140.6128	145.6334	155.0367	167.7363	178.8034	(72)
Total internal gains													
	1195.6527	1192.8825	1153.4607	1082.0186	1006.5416	936.5570	897.3520	901.3087	939.7405	1010.3336	1090.4099	1159.9869	(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	
North	17.8900	9.3942	0.4900	0.0000	0.7700	63.4099	(74)
East	6.3800	17.3606	0.4900	0.0000	0.7700	41.7899	(76)
South	36.9500	41.2355	0.4900	0.0000	0.7700	574.8743	(78)
West	6.0500	17.3606	0.4900	0.0000	0.7700	39.6284	(80)
North	2.3800	14.2848	0.4900	0.0000	1.0000	16.6589	(82)
East	1.1000	22.5763	0.4900	0.0000	1.0000	12.1686	(82)
South	3.1700	38.8506	0.4900	0.0000	1.0000	60.3467	(82)
West	0.7000	22.5763	0.4900	0.0000	1.0000	7.7437	(82)

Solar gains	816.6203	1439.5194	2099.3437	2734.9707	3068.3077	3156.5843	2954.3598	2614.9818	2362.3199	1684.3319	1007.3423	713.4682	(83)
Total gains	2012.2731	2632.4019	3252.8044	3816.9893	4074.8492	4093.1413	3851.7118	3516.2906	3302.0604	2694.6655	2097.7522	1873.4551	(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	45.4112	45.4901	45.4901	45.7171	45.6430	46.0623	46.1262	46.1262	46.0623	45.7895	45.7895	45.7171	

alpha	4.0274	4.0327	4.0327	4.0478	4.0429	4.0708	4.0751	4.0751	4.0708	4.0526	4.0526	4.0478	
util living area	0.9946	0.9840	0.9545	0.8754	0.7279	0.5221	0.3969	0.4540	0.7056	0.9288	0.9877	0.9960	(86)
MIT	19.6465	19.8771	20.1999	20.5570	20.7973	20.9000	20.9180	20.9135	20.8384	20.4922	19.9870	19.5973	(87)
Th 2	20.0630	20.0645	20.0645	20.0687	20.0673	20.0750	20.0762	20.0762	20.0750	20.0700	20.0700	20.0687	(88)
util rest of house	0.9932	0.9802	0.9437	0.8468	0.6706	0.4393	0.3007	0.3516	0.6299	0.9062	0.9842	0.9950	(89)
MIT 2	18.4636	18.7580	19.1635	19.5992	19.8634	19.9639	19.9768	19.9748	19.9159	19.5336	18.9040	18.4049	(90)
Living area fraction									fLA = Living area / (4) =			0.1867	(91)
MIT	18.6844	18.9669	19.3569	19.7780	20.0377	20.1387	20.1525	20.1500	20.0881	19.7126	19.1061	18.6275	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5344	18.8169	19.2069	19.6280	19.8877	19.9887	20.0025	20.0000	19.9381	19.5626	18.9561	18.4775	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9732	0.9311	0.8310	0.6585	0.4312	0.2929	0.3429	0.6175	0.8905	0.9781	0.9926	(94)
Useful gains	1992.2828	2561.8428	3028.7225	3171.9007	2683.4429	1765.0708	1128.0383	1205.8195	2038.9584	2399.7018	2051.8928	1859.5188	(95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	(96)
Heat loss rate W	5681.0364	5536.1732	5021.5605	4116.8297	2961.9619	1801.3314	1133.5230	1216.3882	2200.1173	3491.1380	4671.4895	5703.6061	(97)
Space heating kWh	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98a)
Space heating requirement - total per year (kWh/year)												12671.5604	
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	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												12671.5604	
Space heating per m2										(98c) / (4) =		30.4700	(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.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3486.1858	2810.2491	2894.1372	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8915	0.9286	0.9005	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3107.8128	2609.5867	2606.0547	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4520.2505	4253.0658	3877.8499	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1016.9551	1222.7485	946.2156	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.1948	(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	49.5187	59.5394	46.0742	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												155.1323	(107)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	81.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.6000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	2778.3908	2023.4815	1501.0173	688.7672	209.7822	0.0000	0.0000	0.0000	0.0000	822.0761	1909.4473	2895.3891	(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)	338.8189	246.7593	183.0459	83.9937	25.5825	0.0000	0.0000	0.0000	0.0000	100.2504	232.8530	353.0865	(215)
Water heating													
Water heating requirement	212.0793	140.1233	58.5938	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	88.0461	172.5377	216.3425	(64)
Efficiency of water heater												79.9000	(216)
(217)m	88.1152	88.1822	88.4808	88.9000	88.9000	79.9000	79.9000	79.9000	79.9000	87.8362	87.9856	88.1303	(217)
Fuel for water heating, kWh/month	240.6842	158.9020	66.2221	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.2389	196.0977	245.4802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	8.8426	10.6320	8.2275	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	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	63.7560	51.1475	46.0526	33.7401	26.0618	21.2927	23.7745	30.9030	40.1399	52.6657	59.4858	65.5280	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-85.4020	-125.5718	-189.5999	-217.0242	-230.5451	-216.0986	-210.8160	-197.9422	-180.4158	-148.9907	-96.4338	-74.5687	(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	-9.4331	-21.4937	-48.0670	-161.6627	-292.9094	-338.2629	-314.2617	-210.5899	-101.4405	-33.7506	-13.2818	-7.6070	(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	12828.3514	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	1564.3902	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	1007.6252	(219)
Space cooling fuel	27.7022	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	514.5476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3526.1692	(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	12502.4475	(238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12828.3514	7.3200	939.0353	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1564.3902	6.1400	96.0536	(242)
Water heating (other fuel)	1007.6252	7.3200	73.7582	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Space cooling	27.7022	27.6700	7.6652	(248)
Pumps, fans and electric keep-hot	86.0000	27.6700	23.7962	(249)
Energy for lighting	514.5476	27.6700	142.3753	(250)
Additional standing charges			108.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	27.6700	-546.0423	
PV Unit electricity exported	-1552.7602	5.8100	-90.2154	
Total			-636.2576	(252)
Total energy cost			754.4261	(255)

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	12828.3514	0.2100	2693.9538	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	1564.3902	0.0280	43.8029	(263)
Water heating (other fuel)	1007.6252	0.2100	211.6013	(264)
Space and water heating			2949.3580	(265)
Space cooling	27.7022	0.1142	3.1628	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	514.5476	0.1443	74.2651	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	0.1343	-264.9788	
PV Unit electricity exported	-1552.7602	0.1164	-180.7761	
Total			-445.7550	(269)
Total CO2, kg/year			2592.9602	(272)

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	12828.3514	1.1300	14496.0371	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1564.3902	1.0460	1636.3521	(277)
Water heating (other fuel)	1007.6252	1.1300	1138.6165	(278)
Space and water heating			17271.0057	(279)
Space cooling	27.7022	1.4208	39.3589	(280)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	514.5476	1.5338	789.2303	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	1.4962	-2952.7079	
PV Unit electricity exported	-1552.7602	0.4267	-662.5850	
Total			-3615.2929	(283)
Total Primary energy kWh/year			14614.4028	(286)

SAP 10 EPC IMPROVEMENTS

401 Wilbraham Road

Current energy efficiency rating:	A 95
Current environmental impact rating:	A 92

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Already installed
V2	Wind turbine	Not applicable

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

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.7 -£ 9 -8 kg (0.3%)

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

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 593 TEST (31 Mar 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£174	£174	£0
Mains gas	£1121	£1121	£0
Wood	£96	£96	£0
Space heating	£1167	£1167	£0
Space cooling	£8	£8	£0
Water heating	£74	£74	£0
Lighting	£142	£142	£0
Generated (PV)	-£636	-£636	£0
Total cost of fuels	£755	£755	£0
Total cost of uses	£755	£755	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	2.6 tonnes	2.6 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	35 kWh/m²	35 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800 (1b)	x	2.6700 (2b)	=	484.0176	(1b) - (3b)
First floor	156.5300 (1c)	x	3.0000 (2c)	=	469.5900	(1c) - (3c)
Second floor	78.0600 (1d)	x	2.7700 (2d)	=	216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	1169.8338	(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	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.0684 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2684 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2684 (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	0.3422	0.3355	0.3288	0.2952	0.2885	0.2550	0.2550	0.2483	0.2684	0.2885	0.3019	0.3154	(22b)
Effective ac	0.5585	0.5563	0.5540	0.5436	0.5416	0.5325	0.5325	0.5308	0.5360	0.5416	0.5456	0.5497	(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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)

Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	69649.9100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		167.4800	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0200	0.7556
E3 Sill	22.0600	0.0230	0.5074
E4 Jamb	99.8400	0.0180	1.7971
E5 Ground floor (normal)	57.8000	0.0510	2.9478
E6 Intermediate floor within a dwelling	90.4100	0.0010	0.0904
E16 Corner (normal)	38.2400	0.0400	1.5296
R1 Head of roof window	7.0400	0.2400	1.6896
R2 Sill of roof window	7.0400	0.2400	1.6896
R3 Jamb of roof window	22.6000	0.2400	5.4240
R8 Roof to wall (rafter)	36.2100	0.1200	4.3452
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365
E14 Flat roof	15.3500	0.1600	2.4560
E13 Gable (insulation at rafter level)	7.7000	0.0390	0.3003
E11 Eaves (insulation at rafter level)	49.8000	0.0180	0.8964
R6 Flat ceiling	24.2900	0.1200	2.9148

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		26.3073	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	216.9545	(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	215.6246	214.7469	213.8867	209.8459	209.0899	205.5706	205.5706	204.9188	206.9262	209.0899	210.6193	212.2182	(38)
Heat transfer coeff	432.5791	431.7014	430.8411	426.8004	426.0444	422.5250	422.5250	421.8733	423.8806	426.0444	427.5738	429.1727	(39)
Average = Sum(39)m / 12 =												426.7968	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0402	1.0381	1.0360	1.0263	1.0245	1.0160	1.0160	1.0144	1.0193	1.0245	1.0281	1.0320	(40)
HLP (average)												1.0263	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											3.2826	(42)
Hot water usage for mixer showers												
89.1649	87.8249	85.8723	82.1364	79.3793	76.3047	74.5571	76.4949	78.6191	81.9203	85.7365	88.8233	(42a)
Hot water usage for baths												
34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)
Hot water usage for other uses												
48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)
Average daily hot water use (litres/day)												157.7826	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	171.6182	168.0158	163.5934	156.7840	151.2848	145.3605	143.0213	147.4240	152.0761	158.3037	165.2205	171.1610	(44)
Energy conte	271.8013	239.2523	251.4370	214.6294	203.6584	178.7377	172.9719	182.5417	187.5251	214.8166	235.3869	267.9967	(45)
Energy content (annual)										Total = Sum(45)m =		2620.7550	
Distribution loss (46)m = 0.15 x (45)m													
	40.7702	35.8878	37.7155	32.1944	30.5488	26.8107	25.9458	27.3813	28.1288	32.2225	35.3080	40.1995	(46)
Water storage loss (or HIU loss):													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0206	(55)
Total storage loss													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)
If cylinder contains dedicated solar storage													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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													
	326.7023	288.8403	306.3380	267.7594	258.5594	231.8677	227.8729	237.4427	240.6551	269.7176	288.5169	322.8977	(62)
WWHRS	-80.6639	-71.3399	-74.7030	-61.8570	-57.6485	-49.3302	-46.2392	-49.1708	-51.0390	-60.1693	-68.1645	-79.1702	(63a)
PV diverter	-40.4046	-88.4910	-185.9957	-205.9024	-200.9109	-182.5375	-181.6337	-188.2719	-189.6161	-129.4927	-54.6557	-31.5916	(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													
	205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359	(64)
									Total per year (kWh/year) = Sum(64)m =			838.1707	(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													
	134.2947	119.2218	127.5236	113.8683	111.6372	101.9343	101.4340	104.6159	104.8561	115.3473	120.7701	133.0297	(65)

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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)m	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	72.8395	64.6954	52.6139	39.8321	29.7749	25.1373	27.1617	35.3058	47.3874	60.1692	70.2263	74.8640	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	815.6803	824.1445	802.8150	757.4070	700.0874	646.2152	610.2252	601.7610	623.0905	668.4986	725.8181	779.6904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	(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)													

	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)												
	180.5037	177.4134	171.4027	158.1504	150.0500	141.5754	136.3360	140.6128	145.6334	155.0367	167.7363	178.8034 (72)
Total internal gains												
	1195.6527	1192.8825	1153.4607	1082.0186	1006.5416	936.5570	897.3520	901.3087	939.7405	1010.3336	1090.4099	1159.9869 (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	
North	17.8900	10.6334	0.4900	0.0000	0.7700	71.7743	(74)
East	6.3800	19.6403	0.4900	0.0000	0.7700	47.2775	(76)
South	36.9500	46.7521	0.4900	0.0000	0.7700	651.7815	(78)
West	6.0500	19.6403	0.4900	0.0000	0.7700	44.8321	(80)
North	2.3800	16.1759	0.4900	0.0000	1.0000	18.8643	(82)
East	1.1000	25.5349	0.4900	0.0000	1.0000	13.7633	(82)
South	3.1700	43.9921	0.4900	0.0000	1.0000	68.3329	(82)
West	0.7000	25.5349	0.4900	0.0000	1.0000	8.7585	(82)

Solar gains	925.3845	1590.1328	2219.1532	2833.3499	3257.8558	3273.4621	3139.5132	2815.4368	2429.9661	1768.5125	1110.7604	790.4944 (83)
Total gains	2121.0372	2783.0154	3372.6139	3915.3684	4264.3973	4210.0191	4036.8653	3716.7455	3369.7066	2778.8461	2201.1702	1950.4813 (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	44.7252	44.8162	44.9056	45.3308	45.4112	45.7895	45.7895	45.8602	45.6430	45.4112	45.2488	45.0802
alpha	3.9817	3.9877	3.9937	4.0221	4.0274	4.0526	4.0526	4.0573	4.0429	4.0274	4.0166	4.0053
util living area												
	0.9946	0.9842	0.9589	0.8943	0.7706	0.5995	0.4496	0.5036	0.7413	0.9370	0.9883	0.9961 (86)
MIT	19.5474	19.7898	20.1117	20.4746	20.7409	20.8751	20.9118	20.9052	20.8082	20.4302	19.9070	19.5038 (87)
Th 2	20.0500	20.0517	20.0534	20.0615	20.0630	20.0700	20.0700	20.0713	20.0673	20.0630	20.0599	20.0568 (88)
util rest of house												
	0.9934	0.9807	0.9496	0.8708	0.7235	0.5261	0.3594	0.4097	0.6739	0.9179	0.9851	0.9952 (89)
MIT 2	18.3269	18.6367	19.0436	19.4942	19.7991	19.9388	19.9669	19.9645	19.8796	19.4517	18.7941	18.2762 (90)
Living area fraction										fLA = Living area / (4) =		0.1867 (91)
MIT	18.5547	18.8519	19.2430	19.6772	19.9749	20.1136	20.1433	20.1401	20.0529	19.6343	19.0018	18.5054 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4047	18.7019	19.0930	19.5272	19.8249	19.9636	19.9933	19.9901	19.9029	19.4843	18.8518	18.3554 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9738	0.9375	0.8550	0.7102	0.5172	0.3517	0.4011	0.6606	0.9029	0.9793	0.9928	(94)
Useful gains	2100.3275	2710.1272	3161.8865	3347.8102	3028.4744	2177.3126	1419.7325	1490.8276	2225.8661	2508.9848	2155.5128	1936.4480	(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													
	6101.4103	5958.3027	5425.5695	4535.6893	3461.5741	2266.2378	1433.7378	1514.5854	2459.7493	3785.1236	5024.7696	6075.1119	(97)
Space heating kWh													
	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98a)
Space heating requirement - total per year (kWh/year)												14115.7369	
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													
	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14115.7369	
Space heating per m2											(98c) / (4) =	33.9427	(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	3971.7353	3126.6852	3206.2371	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9152	0.8875	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3415.7320	2861.4798	2845.4387	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4653.0339	4463.4653	4106.1175	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	890.8574	1191.8772	937.9451	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.1948	(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	43.3786	58.0362	45.6715	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												147.0863	(107)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	81.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.6000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2976.8056	2182.7739	1684.1802	855.2729	322.2262	0.0000	0.0000	0.0000	0.0000	949.4472	2065.8649	3079.1660	(98)

Space heating efficiency (main heating system 1)													
	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)													
	3013.6390	2209.7824	1705.0193	865.8556	326.2132	0.0000	0.0000	0.0000	0.0000	961.1952	2091.4268	3117.2659	(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)													
	367.5069	269.4783	207.9235	105.5893	39.7810	0.0000	0.0000	0.0000	0.0000	117.2157	255.0450	380.1439	(215)
Water heating													
Water heating requirement													
	205.6338	129.0095	45.6392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	80.0555	165.6967	212.1359	(64)
Efficiency of water heater												79.9000	(216)
(217)m	88.1919	88.2872	88.6083	88.9000	88.9000	79.9000	79.9000	79.9000	79.9000	88.0504	88.0881	88.1936	(217)
Fuel for water heating, kWh/month													
	233.1664	146.1248	51.5068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.9201	188.1034	240.5343	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	7.7462	10.3636	8.1556	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	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	63.7560	51.1475	46.0526	33.7401	26.0618	21.2927	23.7745	30.9030	40.1399	52.6657	59.4858	65.5280	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-93.9210	-134.1947	-195.6288	-220.5703	-235.9560	-218.8646	-215.4167	-203.9336	-182.8038	-153.3614	-103.4263	-80.7315	(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	-11.2235	-24.5808	-51.6655	-179.4596	-333.2312	-363.2481	-354.8916	-251.5035	-112.6396	-35.9702	-15.1821	-8.7755	(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	14290.3973	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	1742.6836	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	950.3558	(219)
Space cooling fuel	26.2654	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	514.5476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3781.1799	(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	13829.0697	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	14290.3973	3.6400	520.1705	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1742.6836	5.1200	89.2254	(242)
Water heating (other fuel)	950.3558	3.6400	34.5930	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Space cooling	26.2654	16.4900	4.3312	(248)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	514.5476	16.4900	84.8489	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	16.4900	-336.1996	
PV Unit electricity exported	-1742.3712	5.5900	-97.3986	
Total			-433.5981	(252)
Total energy cost			405.7522	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.3169	(257)
SAP value	94.8623	
SAP rating (Section 12)	95	(258)
SAP band	A	

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	14290.3973	0.2100	3000.9834	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	1742.6836	0.0280	48.7951	(263)
Water heating (other fuel)	950.3558	0.2100	199.5747	(264)
Space and water heating			3249.3533	(265)
Space cooling	26.2654	0.1140	2.9933	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	514.5476	0.1443	74.2651	(268)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2038.8087	0.1346	-274.3506	
PV Unit electricity exported	-1742.3712	0.1162	-202.5487	
Total			-476.8993	(269)
Total CO2, kg/year			2861.6417	(272)
CO2 emissions per m2			6.8800	(273)
EI value			91.6796	
EI rating			92	(274)
EI band			A	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	181.2800 (1b)	x	2.6700 (2b)	=	484.0176	(1b) - (3b)
First floor	156.5300 (1c)	x	3.0000 (2c)	=	469.5900	(1c) - (3c)
Second floor	78.0600 (1d)	x	2.7700 (2d)	=	216.2262	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	415.8700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	1169.8338	(5)

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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	8 * 10 =	80.0000	(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) =	80.0000 / (5) =	0.0684	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2684	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2684	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000	(22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750	(22a)
Adj infilt rate	0.2885	0.2818	0.2818	0.2617	0.2684	0.2281	0.2214	0.2214	0.2281	0.2550	0.2550	0.2617	(22b)
Effective ac	0.5416	0.5397	0.5397	0.5342	0.5360	0.5260	0.5245	0.5245	0.5260	0.5325	0.5325	0.5342	(25)

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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	
Main dwelling								
Half Glazed Door			2.1400	1.2100	2.5894			(26a)
Window			67.2700	1.1541	77.6390			(27)
Roof Window			7.3500	1.1541	10.9581			(27a)
Ground Floor			181.2800	0.1100	19.9408	110.0000	19940.8000	(28a)
External Wall	311.7400	69.4100	242.3300	0.1700	41.1961	110.0000	26656.3000	(29a)
Stud Wall	66.1900		66.1900	0.1100	7.2809	9.0000	595.7100	(29a)
Slope Roof	153.5900	7.3500	146.2400	0.1500	21.9360	9.0000	1316.1600	(30)
Flat Roof	53.5700		53.5700	0.1700	9.1069	9.0000	482.1300	(30)
Total net area of external elements Aum(A, m2)			766.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		190.6471			(33)
Main dwelling								
Heavy			175.8700			75.0000	13190.2500	(32c)
Light			126.0700			9.0000	1134.6300	(32c)
Internal Floor - First			156.5300			18.0000	2817.5400	(32d)
Internal Floor - Second			78.0600			18.0000	1405.0800	(32d)
Internal Ceiling - Ground			156.5300			9.0000	1408.7700	(32e)
Internal Ceiling - First			78.0600			9.0000	702.5400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	69649.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		167.4800 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	37.7800	0.0200	0.7556
E3 Sill	22.0600	0.0230	0.5074
E4 Jamb	99.8400	0.0180	1.7971
E5 Ground floor (normal)	57.8000	0.0510	2.9478
E6 Intermediate floor within a dwelling	90.4100	0.0010	0.0904
E16 Corner (normal)	38.2400	0.0400	1.5296
R1 Head of roof window	7.0400	0.2400	1.6896
R2 Sill of roof window	7.0400	0.2400	1.6896
R3 Jamb of roof window	22.6000	0.2400	5.4240

R8 Roof to wall (rafter)	36.2100	0.1200	4.3452	
E17 Corner (inverted - internal area greater than external area)	12.6400	-0.0820	-1.0365	
E14 Flat roof	15.3500	0.1600	2.4560	
E13 Gable (insulation at rafter level)	7.7000	0.0390	0.3003	
E11 Eaves (insulation at rafter level)	49.8000	0.0180	0.8964	
R6 Flat ceiling	24.2900	0.1200	2.9148	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				26.3073 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	216.9545 (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	209.0899	208.3513	208.3513	206.2397	206.9262	203.0679	202.4857	202.4857	203.0679	205.5706	205.5706	206.2397	(38)
Heat transfer coeff	426.0444	425.3057	425.3057	423.1941	423.8806	420.0224	419.4402	419.4402	420.0224	422.5250	422.5250	423.1941	(39)
Average = Sum(39)m / 12 =												422.5750	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0227	1.0227	1.0176	1.0193	1.0100	1.0086	1.0086	1.0100	1.0160	1.0160	1.0176	(40)
HLP (average)												1.0161	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.2826 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
89.1649	87.8249	85.8723	82.1364	79.3793	76.3047	74.5571	76.4949	78.6191	81.9203	85.7365	88.8233	(42a)

Hot water usage for baths

34.2066	33.6986	32.9832	31.6642	30.6765	29.5813	28.9897	29.7001	30.4736	31.6455	32.9917	34.0910	(42b)

Hot water usage for other uses

48.2467	46.4923	44.7379	42.9834	41.2290	39.4746	39.4746	41.2290	42.9834	44.7379	46.4923	48.2467	(42c)

Average daily hot water use (litres/day) 157.7826 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	171.6182	168.0158	163.5934	156.7840	151.2848	145.3605	143.0213	147.4240	152.0761	158.3037	165.2205	171.1610	(44)
Energy conte	271.8013	239.2523	251.4370	214.6294	203.6584	178.7377	172.9719	182.5417	187.5251	214.8166	235.3869	267.9967	(45)
Energy content (annual)										Total = Sum(45)m =		2620.7550	
Distribution loss (46)m = 0.15 x (45)m	40.7702	35.8878	37.7155	32.1944	30.5488	26.8107	25.9458	27.3813	28.1288	32.2225	35.3080	40.1995	(46)

Water storage loss (or HIU loss):

Store volume	300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.8900 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.0206 (55)

Total storage loss

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)

If cylinder contains dedicated solar storage

31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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

326.7023	288.8403	306.3380	267.7594	258.5594	231.8677	227.8729	237.4427	240.6551	269.7176	288.5169	322.8977	(62)
WWHRS -80.6639	-71.3399	-74.7030	-61.8570	-57.6485	-49.3302	-46.2392	-49.1708	-51.0390	-60.1693	-68.1645	-79.1702	(63a)
PV diverter -33.9591	-77.3771	-173.0411	-205.9024	-200.9109	-182.5375	-181.6337	-188.2719	-189.6161	-121.5022	-47.8146	-27.3851	(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

212.0793	140.1233	58.5938	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	88.0461	172.5377	216.3425	(64)
								Total per year (kWh/year) = Sum(64)m =			887.7228	(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

134.2947	119.2218	127.5236	113.8683	111.6372	101.9343	101.4340	104.6159	104.8561	115.3473	120.7701	133.0297	(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	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	196.9537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.8395	64.6954	52.6139	39.8321	29.7749	25.1373	27.1617	35.3058	47.3874	60.1692	70.2263	74.8640	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	815.6803	824.1445	802.8150	757.4070	700.0874	646.2152	610.2252	601.7610	623.0905	668.4986	725.8181	779.6904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	57.9779	(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)	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	-131.3024	(71)
Water heating gains (Table 5)	180.5037	177.4134	171.4027	158.1504	150.0500	141.5754	136.3360	140.6128	145.6334	155.0367	167.7363	178.8034	(72)
Total internal gains	1195.6527	1192.8825	1153.4607	1082.0186	1006.5416	936.5570	897.3520	901.3087	939.7405	1010.3336	1090.4099	1159.9869	(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	
North	17.8900	9.3942	0.4900	0.0000	0.7700	63.4099	(74)
East	6.3800	17.3606	0.4900	0.0000	0.7700	41.7899	(76)
South	36.9500	41.2355	0.4900	0.0000	0.7700	574.8743	(78)
West	6.0500	17.3606	0.4900	0.0000	0.7700	39.6284	(80)
North	2.3800	14.2848	0.4900	0.0000	1.0000	16.6589	(82)
East	1.1000	22.5763	0.4900	0.0000	1.0000	12.1686	(82)
South	3.1700	38.8506	0.4900	0.0000	1.0000	60.3467	(82)
West	0.7000	22.5763	0.4900	0.0000	1.0000	7.7437	(82)

Solar gains	816.6203	1439.5194	2099.3437	2734.9707	3068.3077	3156.5843	2954.3598	2614.9818	2362.3199	1684.3319	1007.3423	713.4682	(83)
Total gains	2012.2731	2632.4019	3252.8044	3816.9893	4074.8492	4093.1413	3851.7118	3516.2906	3302.0604	2694.6655	2097.7522	1873.4551	(84)

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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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.4112	45.4901	45.4901	45.7171	45.6430	46.0623	46.1262	46.1262	46.0623	45.7895	45.7895	45.7171	
alpha	4.0274	4.0327	4.0327	4.0478	4.0429	4.0708	4.0751	4.0751	4.0708	4.0526	4.0526	4.0478	
util living area	0.9946	0.9840	0.9545	0.8754	0.7279	0.5221	0.3969	0.4540	0.7056	0.9288	0.9877	0.9960	(86)
MIT	19.6465	19.8771	20.1999	20.5570	20.7973	20.9000	20.9180	20.9135	20.8384	20.4922	19.9870	19.5973	(87)
Th 2	20.0630	20.0645	20.0645	20.0687	20.0673	20.0750	20.0762	20.0762	20.0750	20.0700	20.0700	20.0687	(88)
util rest of house	0.9932	0.9802	0.9437	0.8468	0.6706	0.4393	0.3007	0.3516	0.6299	0.9062	0.9842	0.9950	(89)
MIT 2	18.4636	18.7580	19.1635	19.5992	19.8634	19.9639	19.9768	19.9748	19.9159	19.5336	18.9040	18.4049	(90)
Living area fraction										fLA = Living area / (4) =		0.1867	(91)
MIT	18.6844	18.9669	19.3569	19.7780	20.0377	20.1387	20.1525	20.1500	20.0881	19.7126	19.1061	18.6275	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5344	18.8169	19.2069	19.6280	19.8877	19.9887	20.0025	20.0000	19.9381	19.5626	18.9561	18.4775	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9732	0.9311	0.8310	0.6585	0.4312	0.2929	0.3429	0.6175	0.8905	0.9781	0.9926	(94)
Useful gains	1992.2828	2561.8428	3028.7225	3171.9007	2683.4429	1765.0708	1128.0383	1205.8195	2038.9584	2399.7018	2051.8928	1859.5188	(95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	(96)
Heat loss rate W	5681.0364	5536.1732	5021.5605	4116.8297	2961.9619	1801.3314	1133.5230	1216.3882	2200.1173	3491.1380	4671.4895	5703.6061	(97)
Space heating kWh	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98a)
Space heating requirement - total per year (kWh/year)												12671.5604	
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	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12671.5604	
Space heating per m2											(98c) / (4) =	30.4700	(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.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3486.1858	2810.2491	2894.1372	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8915	0.9286	0.9005	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	3107.8128	2609.5867	2606.0547	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4520.2505	4253.0658	3877.8499	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1016.9551	1222.7485	946.2156	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.1948	(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	49.5187	59.5394	46.0742	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												155.1323	(107)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	81.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	5.6000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2744.4327	1998.7500	1482.6715	680.3489	207.2182	0.0000	0.0000	0.0000	0.0000	812.0285	1886.1096	2860.0010	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	2778.3908	2023.4815	1501.0173	688.7672	209.7822	0.0000	0.0000	0.0000	0.0000	822.0761	1909.4473	2895.3891	(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)	338.8189	246.7593	183.0459	83.9937	25.5825	0.0000	0.0000	0.0000	0.0000	100.2504	232.8530	353.0865	(215)
Water heating													
Water heating requirement	212.0793	140.1233	58.5938	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	88.0461	172.5377	216.3425	(64)
Efficiency of water heater												79.9000	(216)
(217)m	88.1152	88.1822	88.4808	88.9000	88.9000	79.9000	79.9000	79.9000	79.9000	87.8362	87.9856	88.1303	(217)
Fuel for water heating, kWh/month	240.6842	158.9020	66.2221	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.2389	196.0977	245.4802	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	8.8426	10.6320	8.2275	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	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	63.7560	51.1475	46.0526	33.7401	26.0618	21.2927	23.7745	30.9030	40.1399	52.6657	59.4858	65.5280	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-85.4020	-125.5718	-189.5999	-217.0242	-230.5451	-216.0986	-210.8160	-197.9422	-180.4158	-148.9907	-96.4338	-74.5687	(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	-9.4331	-21.4937	-48.0670	-161.6627	-292.9094	-338.2629	-314.2617	-210.5899	-101.4405	-33.7506	-13.2818	-7.6070	(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	12828.3514	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	1564.3902	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	1007.6252	(219)
Space cooling fuel	27.7022	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	514.5476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3526.1692	(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	12502.4475	(238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	12828.3514	7.3200	939.0353	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1564.3902	6.1400	96.0536	(242)
Water heating (other fuel)	1007.6252	7.3200	73.7582	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Space cooling	27.7022	27.6700	7.6652	(248)
Pumps, fans and electric keep-hot	86.0000	27.6700	23.7962	(249)
Energy for lighting	514.5476	27.6700	142.3753	(250)
Additional standing charges			108.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	27.6700	-546.0423	
PV Unit electricity exported	-1552.7602	5.8100	-90.2154	
Total			-636.2576	(252)
Total energy cost			754.4261	(255)

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	12828.3514	0.2100	2693.9538	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	1564.3902	0.0280	43.8029	(263)
Water heating (other fuel)	1007.6252	0.2100	211.6013	(264)
Space and water heating			2949.3580	(265)
Space cooling	27.7022	0.1142	3.1628	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	514.5476	0.1443	74.2651	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	0.1343	-264.9788	
PV Unit electricity exported	-1552.7602	0.1164	-180.7761	
Total			-445.7550	(269)
Total CO2, kg/year			2592.9602	(272)

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	12828.3514	1.1300	14496.0371	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	1564.3902	1.0460	1636.3521	(277)
Water heating (other fuel)	1007.6252	1.1300	1138.6165	(278)
Space and water heating			17271.0057	(279)
Space cooling	27.7022	1.4208	39.3589	(280)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	514.5476	1.5338	789.2303	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1973.4089	1.4962	-2952.7079	
PV Unit electricity exported	-1552.7602	0.4267	-662.5850	
Total			-3615.2929	(283)
Total Primary energy kWh/year			14614.4028	(286)

Predicted Energy Assessment

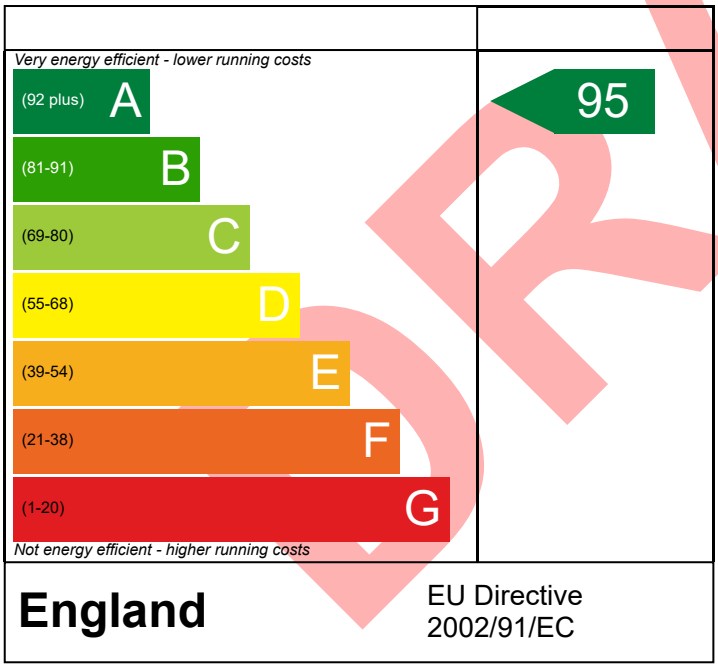
401, Wilbraham Road, Manchester, M21 0UT

Dwelling type:	House, Detached
Date of assessment:	07/04/2026
SAP Version:	10.2
Produced by:	Daniel Crew
Total floor area:	415.87 m²
DRRN:	

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.

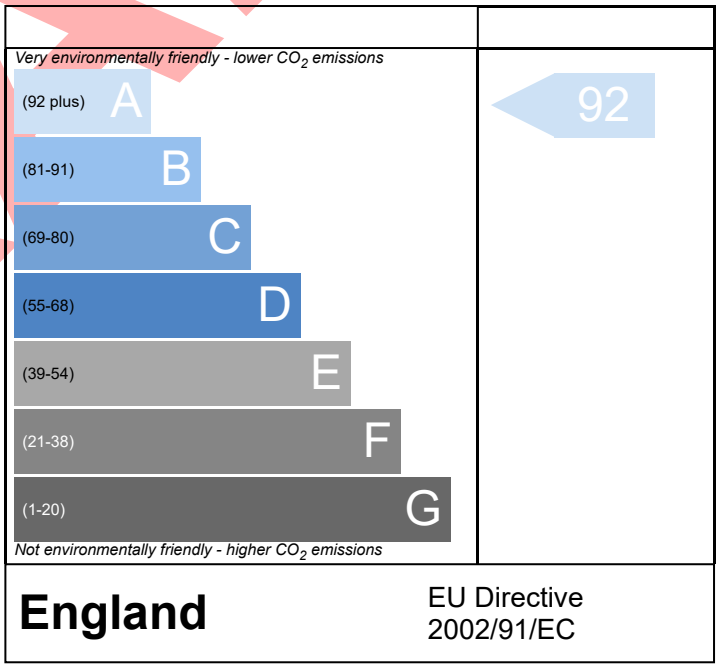
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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.

Environmental Impact (CO_2) Rating



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

DRAFT

Summary for Input Data

elmhurst energy

Plot Reference	401 Wilbraham Road	**Issued on Date**	07/04/2026
Assessment Reference	401 Wilbraham Road	**Plot Type Ref**	
Plot Address	401, Wilbraham Road, Manchester, M21 0UT	**SAP Version**	10.2

SAP Rating	95 A	**DER**	7.04	**TER**	7.63
Environmental	92 A	**% DER < TER**			7.73
CO_2 Emissions (t/year)	2.59	**DFEE**	37.65	**TFEE**	41.32
Compliance Check	See BREL	**% DFEE < TFEE**			8.88
% DPER < TPER	2.14	**DPER**	39.89	**TPER**	40.76

Assessor Details	Mr. Daniel Crew	**Assessor ID**	AT06-0001
Client	., Omar Fiaz		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	3	
3.0 Date Built	2026	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	167.48	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	57.80 m	181.28 m²	2.67 m
1st Storey:	54.20 m	156.53 m²	3.00 m
2nd Storey:	36.21 m	78.06 m²	2.77 m

8.0 Living Area	77.63	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.17	110.00	311.74	242.33	0.00	None	69.41	Enter Gross Area
Stud Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.11	9.00	66.19	66.19	0.00	None	0.00	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Heavy	Dense block, plasterboard on dabs	75.00	175.87
Light	Plasterboard on timber frame	9.00	126.07

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Slope Roof	External Slope Roof	Plasterboard, insulated slope	0.15	9.00	153.59	146.25	None	0.00	Enter Gross Area	7.34
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.17	9.00	53.57	53.57	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Kappa	Area (m²)
Internal Ceiling - Ground	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	9.00	156.53
Internal Ceiling - First	+1	Plasterboard ceiling, carpeted chipboard floor	9.00	78.06

11.0 Heat Loss Floors

Summary for Input Data

elmhurst energy

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.11	None	0.00	110.00	181.28

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor - First	+1	Plasterboard ceiling, carpeted chipboard floor	18.00	156.53
Internal Floor - Second	+2	Plasterboard ceiling, carpeted chipboard floor	18.00	78.06

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Half Glazed Door	BFRC, BSI or CERTASS data	Half Glazed Door	Double glazed			0.49			1.21
Window	BFRC, BSI or CERTASS data	Window	Double glazed			0.49			1.21
Roof Window	BFRC, BSI or CERTASS data	Roof Window	Double glazed			0.49			1.21

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
R1	Roof Window	Slope Roof	North	2.38	35
W1	Window	External Wall	North	5.28	
W2	Window	External Wall	North	4.28	
W3	Window	External Wall	North	4.80	
W4	Window	External Wall	North	3.53	
D1	Half Glazed Door	External Wall	West	2.14	
R2	Roof Window	Slope Roof	West	0.70	50
W5	Window	External Wall	West	0.48	
W6	Window	External Wall	West	1.09	
W7	Window	External Wall	West	2.07	
W8	Window	External Wall	West	0.96	
W9	Window	External Wall	West	1.45	
R1	Roof Window	Slope Roof	South	3.17	35
W10	Window	External Wall	South	12.35	
W11	Window	External Wall	South	7.12	
W12	Window	External Wall	South	3.84	
W13	Window	External Wall	South	2.35	
W14	Window	External Wall	South	11.29	
R3	Roof Window	Slope Roof	East	1.10	50
W5	Window	External Wall	East	0.48	
W7	Window	External Wall	East	2.07	
W9	Window	External Wall	East	2.17	
W15	Window	External Wall	East	1.66	

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	37.78	0.02	0.02	RCD	Yes
E3 Sill	Independently assessed	22.06	0.02	0.02	RCD	No
E4 Jamb	Independently assessed	99.84	0.02	0.02	RCD	Yes
E5 Ground floor (normal)	Independently assessed	57.80	0.05	0.05	RCD	Yes
E6 Intermediate floor within a dwelling	Independently assessed	90.41	0.00	0.00	RCD	Yes
E16 Corner (normal)	Independently assessed	38.24	0.04	0.04	RCD	No
R1 Head of roof window	Table K1 - Default	7.04	0.24	0.24		Yes
R2 Sill of roof window	Table K1 - Default	7.04	0.24	0.24		Yes
R3 Jamb of roof window	Table K1 - Default	22.60	0.24	0.24		Yes
R8 Roof to wall (rafter)	Table K1 - Default	36.21	0.12	0.12		No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	12.64	-0.08	-0.08	RCD	No
E14 Flat roof	Table K1 - Default	15.35	0.16	0.16		No
E13 Gable (insulation at rafter level)	Independently assessed	7.70	0.04	0.04	RCD	No
E11 Eaves (insulation at rafter level)	Independently assessed	49.80	0.02	0.02	RCD	No
R6 Flat ceiling	Table K1 - Default	24.29	0.12	0.12		No

Y-value 0.03 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present: No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys: 0

Number of open flues: 0

Number of chimneys/flues attached to closed fire: 0

Summary for Input Data

elmhurst energy

Number of flues attached to solid fuel boiler	0	
Number of flues attached to other heater	0	
Number of blocked chimneys	0	
Number of intermittent extract fans	8	
Number of passive vents	0	
Number of flueless gas fires	0	
21.0 Fixed Cooling System	Yes	
Cooled Area	81	m²
Data Source	SAP table	
Energy Class	A+	
22.0 Pressure Testing	Yes	
Designed AP_{50}	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
LED	94.00	5.00	470.00	65

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	19024	
Fuel Type	Mains gas	
In Winter	88.90	
In Summer	79.90	
Model Name	LOGIC MAX SYSTEM2	
Manufacturer	Ideal Boilers	
System Type	Regular boiler	
Controls SAP Code	2110	
Controls description	Time and temperature zone control by arrangement	
Delayed Start Stat	Yes	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Unknown	
Boiler Interlock	Yes	
25.0 Main Heating 2	None	
26.0 Heat Networks	None	
27.0 Secondary Heating	Manufacturer	
SAP Code	633	
Heating System Description	Solid fuel Closed room heater	
Fuel Type	Wood Logs	
SHS efficiency	81.00	%
HETAS Approved System	No	
Test Method	not specified	

Summary for Input Data

Manufacturer	Contura
Model Name	810 Style

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	Yes
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower 1	Combi boiler or unvented hot water system	9.00		Yes	Instantaneous System 1
Shower 2	Combi boiler or unvented hot water system	9.00		Yes	Instantaneous System 1
Shower 3	Combi boiler or unvented hot water system	9.00		Yes	Instantaneous System 1
Shower 4	Combi boiler or unvented hot water system	9.00		Yes	Instantaneous System 1
Shower 5	Combi boiler or unvented hot water system	9.00		Yes	Instantaneous System 1

28.3 Waste Water Heat Recovery System
Instantaneous System 1

Database ID	80182	
Brand Model	Showersave, Blue QB1-21D	
Details	Year: 2020 + current Efficiency: 73.8 Utilisation factor: 0.946	

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	300.00	L
Loss	1.89	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store	None

32.0 Photovoltaic Unit	One Dwelling	
Export Capable Meter?	Yes	
Connected To Dwelling	Yes	
Diverter	Yes	
Battery Capacity [kWh]	0.00	

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
3.15	East	45°	None Or Little		No	1.00		
4.05	South	30°	None Or Little		No	1.00		

34.0 Small-scale Hydro	None

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

Recommendations
Lower cost measures
None
Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating			A 96	A 92
Photovoltaic			0	0
Wind turbine			0	0

Thermal Bridging

Plot Reference	401 Wilbraham Road	**Issued on Date**	07/04/2026
Assessment Reference	401 Wilbraham Road	**Plot Type Ref**	Detached House
Plot Address	401, Wilbraham Road, Manchester, M21 0UT	**SAP Version**	10.2

SAP Rating	95 A	**DER**	7.04	**TER**	7.63
Environmental	92 A	**% DER < TER**			7.73
CO_2 Emissions (t/year)	2.59	**DFEE**	37.65	**TFEE**	41.32
Compliance Check	See BREL	**% DFEE < TFEE**			8.88
% DPER < TPER	2.14	**DPER**	39.89	**TPER**	40.76

Assessor Details	Mr. Daniel Crew	**Assessor ID**	AT06-0001
Client	., Omar Fiaz		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.020	37.78	0.76	RCD
External wall	E3 Sill	Independently assessed	0.023	22.06	0.51	RCD
External wall	E4 Jamb	Independently assessed	0.018	99.84	1.80	RCD
External wall	E5 Ground floor (normal)	Independently assessed	0.051	57.80	2.95	RCD
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	90.41	0.09	RCD
External wall	E16 Corner (normal)	Independently assessed	0.040	38.24	1.53	RCD
External roof	R1 Head of roof window	Table K1 - Default	0.240	7.04	1.69	
External roof	R2 Sill of roof window	Table K1 - Default	0.240	7.04	1.69	
External roof	R3 Jamb of roof window	Table K1 - Default	0.240	22.60	5.42	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.120	36.21	4.35	
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.082	12.64	-1.04	RCD
External wall	E14 Flat roof	Table K1 - Default	0.160	15.35	2.46	
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.039	7.70	0.30	RCD
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.018	49.80	0.90	RCD
External roof	R6 Flat ceiling	Table K1 - Default	0.120	24.29	2.91	

Total: 528.80 W/mK:

Y-Value: 0.03 W/m²K:

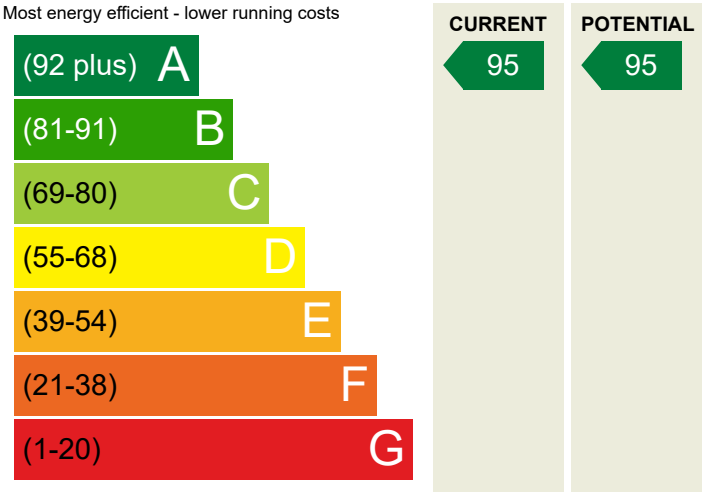
Energy Report

Dwelling Address	401, Wilbraham Road, Manchester, M21 0UT
Reference	401 Wilbraham Road-401 Wilbraham Road
SAP Version	10.2
Assessment Date	28/01/2026
Submission Date	
Property Type	House, Detached
Total Floor Area	416

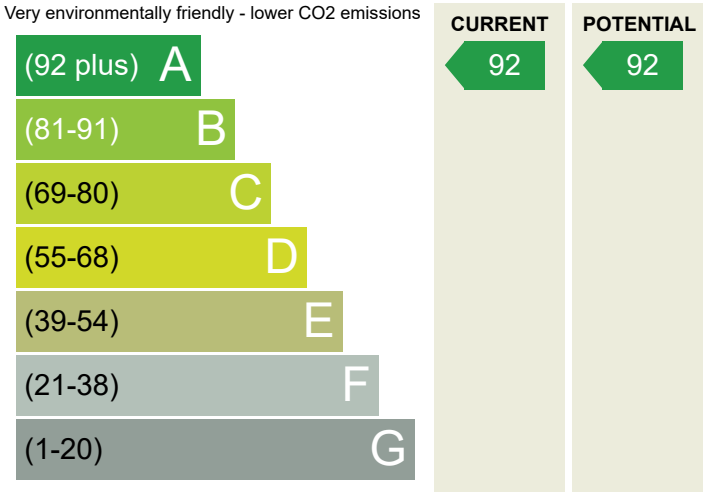
This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Efficiency Rating

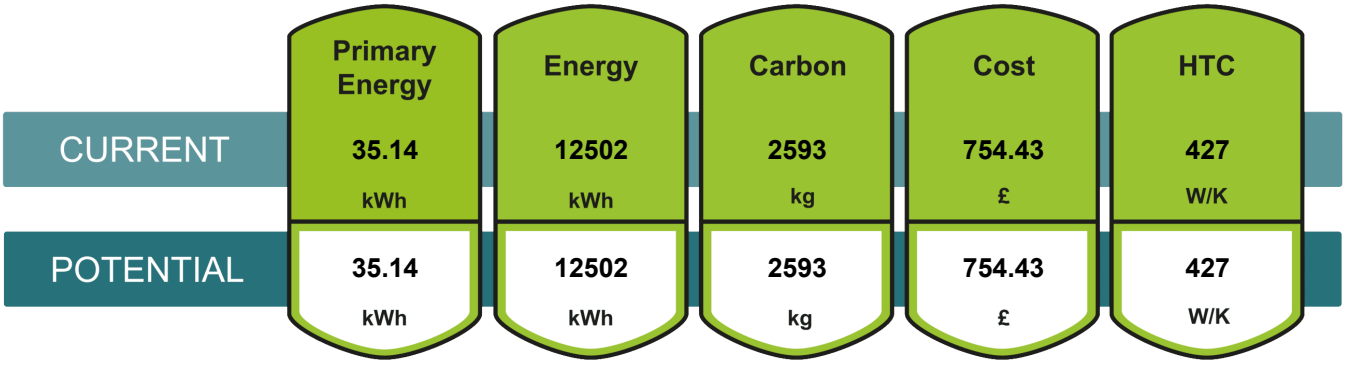


Carbon Dioxide (CO2) Emissions Rating



Additional ratings for your home

Energy Report



Energy Report

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor | Poor | Average | Good | Very Good

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.16 W/m²K	Very Good
Roof	Average thermal transmittance 0.16 W/m²K	Very Good
Floor	Average thermal transmittance 0.11 W/m²K	Very Good
Windows	High performance glazing	Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	Room heaters, wood logs	
Hot water	From main system, waste water heat recovery	Very Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 4.0 m³/h.m² (assumed)	Good

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling.
To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed.
Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measures	Cumulative savings (per year)	Cumulative rating	Typical costs	Incremental savings (per year)	Cumulative CO2 rating
Solar water heating	£9	A 96			A 92

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

Energy Report

Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

	Estimated annual costs	Estimated annual costs after potential improvements	Potential future savings
Lighting	£142	£142	
Heating	£1167	£1167	
Hot Water	£74	£74	
New Technologies e.g. Impact of PV	-(£636)	-(£636)	
TOTAL	£747	£747	

Estimated energy use and potential savings

Space Heating
12828
kWh per year

Water Heating
1008
kWh per year

Energy Report

About this document

Created by:	
Company/Trading name:	
Phone number:	
Email address:	

Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g.heating system) is working correctly.
This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.
This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.
The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

Glossary terms for additional metrics

Primary Energy	The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property.
Energy Used	The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.
Carbon (CO2)	The current emissions based on the energy estimates.
Cost	The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.
Heat Transfer Coefficient	Heat flow through the property envelope where internal and external temperatures are different.



SAP Report Submission for Building Regulations Compliance

Client: Omar Fiaz
U-value Calculations

Project: 401 Wilbraham Road, Chorlton, Manchester, M21 0UT

Contact: Daniel Crew
[redacted]

Report Issue Date:

EXCELLENCE IN ENERGY ASSESSMENT

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	401 Wilbraham Road	**Issued on Date**	30/01/2026
Assessment Reference		**Prop Type Ref**	401 Wilbraham Road
Project	401, Wilbraham Road, Chorlton, Manchester, M21 0UT		
Calculation Type	New Build (As Designed)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details	Mr. Daniel Crew, Daniel Crew, [redacted]	**Assessor ID**	AT06-0001
Client			

Building Elements

Wall External Wall - 0.17 - 150mm Dritherm 32

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Brick, outer leaf**				
	Main construction	100	0.7700	0.1299	82.81
	Main construction	100	0.9407	0.1063	17.19
Layer 2	**Earthwool Dritherm 32 Ultimate**				
	Main construction	50	0.0320	1.5625	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	**Earthwool Dritherm 32 Ultimate**				
	Main construction	100	0.0320	3.1250	100.00
	Corrections - Air Gap: Level 1, Fasteners: Wall ties, Cross sectional area: 0.00 mm², Lambda: 0.000 W/m.K, per m²: 2.500				
Layer 4	**Celcon Standard - Normal - Trad joint 10mm**				
	Main construction	100	0.1500	0.6667	93.18
	Main construction	100	0.8803	0.1136	6.82
Layer 5	**airspace/plaster dabs**				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	**Gyproc Wallboard (12.5mm)**				
	Main construction	12.5	0.1900	0.0658	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: **Upper limit =** 5.852 m² K/W **Lower limit =** 5.726 m² K/W **Average =** 5.789 m² K/W

Total correction = 0.0036 m² K/W **U-value (unrounded) =** 0.17 W/m² K

Unheated space: None

Total thickness: 381 mm **U-value: 0.17 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	401 Wilbraham Road	**Issued on Date**	30/01/2026
Assessment Reference		**Prop Type Ref**	401 Wilbraham Road
Project	401, Wilbraham Road, Chorlton, Manchester, M21 0UT		
Calculation Type	New Build (As Designed)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details	Mr. Daniel Crew, Daniel Crew [redacted]	**Assessor ID**	AT06-0001
Client			

Building Elements

Floor Ground Floor - 0.11 - 150mm XR4000

Floor Type: Slab On Ground Floor
Area = 181.28 m², Perimeter = 57.80 m, Wall thickness = 381.00 mm, Soil: Clay
Horizontal edge insulation: none
Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**DPM**				
	Main construction	1	0.0000	0.0000	100.00
Layer 2	**Concrete, medium density**				
	Main construction	100	1.3500	0.0741	100.00
Layer 3	**Celotex XR4000**				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	**500 Gauge Separating Layer**				
	Main construction	1	0.0000	0.0000	100.00
Layer 5	**Screed**				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: **Upper limit =** 6.957 m² K/W **Lower limit =** 6.957 m² K/W **Average =** 6.957 m² K/W

Total correction = 0.0096 m² K/W **U-value (unrounded) =** 0.11 W/m² K

Unheated space: None

Total thickness: 327 mm **U-value: 0.11 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	401 Wilbraham Road	**Issued on Date**	30/01/2026
Assessment Reference		**Prop Type Ref**	401 Wilbraham Road
Project	401, Wilbraham Road, Chorlton, Manchester, M21 0UT		
Calculation Type	New Build (As Designed)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details	Mr. Daniel Crew, Daniel Crew, [redacted]	**Assessor ID**	AT06-0001
Client			

Building Elements

Roof Slope Roof - 0.15 - 100mm GA4000 + PL4060

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.1000	
Layer 1	**Tiling, clay**				
	Main construction	15	1.0000	0.0000	100.00
Layer 2	**airspace/timber battens**				
	Main construction	22	0.1222	0.0000	89.63
	Main construction	22	0.1375	0.0000	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	**Clear Air Gap**				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Normal				
Layer 4	**Breather membrane**				
	Main construction	1	0.0000	0.0000	100.00
Layer 5	**Celotex GA4000**				
	Main construction	100	0.0220	4.5455	91.67
	Main construction	100	0.1300	0.7692	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	**Celotex PL4060 [72.5mm]**				
	Main construction	72.5	0.0264	2.7500	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: **Upper limit =** 6.919 m² K/W **Lower limit =** 6.183 m² K/W **Average =** 6.551 m² K/W

Total correction = 0.0042 m² K/W **U-value (unrounded) =** 0.15 W/m² K

Unheated space: None

Total thickness: 264 mm **U-value: 0.15 W/m² K** **Kappa: n/a**

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	401 Wilbraham Road	**Issued on Date**	30/01/2026
Assessment Reference		**Prop Type Ref**	401 Wilbraham Road
Project	401, Wilbraham Road, Chorlton, Manchester, M21 0UT		
Calculation Type	New Build (As Designed)		

SAP Rating		**DER**		**TER**	
Environmental		**% DER<TER**			
CO_2 Emissions (t/year)		**DFEE**		**TFEE**	
General Requirements Compliance		**% DFEE<TFEE**			

Assessor Details	Mr. Daniel Crew, Daniel Crew, [redacted]	**Assessor ID**	AT06-0001
Client			

Building Elements

Roof Flat Roof - 0.17 - 120mm XR4000

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	**Single Ply Membrane**				
	Main construction	3	0.0300	0.1000	100.00
Layer 2	**Celotex XR4000**				
	Main construction	120	0.0220	5.4545	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	**VCL**				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	**Plywood**				
	Main construction	18	0.1300	0.1385	100.00
Layer 5	**Joists**				
	Main construction	200	1.2500	0.1600	91.67
	Main construction	200	0.1300	1.5385	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	**Gyproc Wallboard (12.5mm)**				
	Main construction	12.5	0.1900	0.0658	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	**Plaster, standard**				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: **Upper limit =** 6.161 m² K/W **Lower limit =** 6.079 m² K/W **Average =** 6.120 m² K/W

Total correction = 0.0079 m² K/W **U-value (unrounded) =** 0.17 W/m² K

Unheated space: None

Total thickness: 358 mm **U-value: 0.17 W/m² K** **Kappa: n/a**