

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 27 May 2026 08:46:03

Project Information			
Assessed By	Harry Davey	Building Type	House, Detached
OCDEA Registration	EES/020345	Assessment Date	2026-05-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	471 m ²
Site Reference	5791	Plot Reference	v3
Address	The Moorings, Reading, RG4 7EJ		

Client Details	
Name	.
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	Electricity	
Target carbon dioxide emission rate	8.82 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	3.25 kgCO ₂ /m ²	OK

1b Target primary energy rate and dwelling primary energy		
Target primary energy	47.6 kWh _{PE} /m ²	
Dwelling primary energy	34.22 kWh _{PE} /m ²	OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	49.7 kWh/m ²	
Dwelling fabric energy efficiency	49.0 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.15	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	0.1	exposed floor (0.15)	OK
Roofs	0.16	0.11	Roof (6) (0.18)	OK
Windows, doors, and roof windows	1.6	1.38	Opening (1.4)	OK
Rooflights	2.2	1.2	Opening, South (1.2)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	303.7455	0.17
Exposed wall: Walls (2)	3.535	0.17
Exposed wall: Walls (3)	105.3	0.09 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	228.66	0.1 (!)
Upper floor: exposed floor, exposed floor	2.88	0.15
Exposed roof: Roof (1)	86.1856	0.13
Exposed roof: Roof (2)	16.48	0.12
Exposed roof: Roof (3)	35.4	0.11
Exposed roof: Roof (4)	33.29	0.12
Exposed roof: Roof (5)	72.96	0.09 (!)
Exposed roof: Roof (6)	4.45	0.18

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening, Door	6.72	South	N/A	1.2
Opening, Window	1.568	South	0.7	1.4
Opening, Window	3.78	South	0.7	1.4
Opening, Window	2.025	South	0.7	1.4
Opening, Window	2.025	South	0.7	1.4
Opening, Window	2.025	South	0.7	1.4

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening, Window	2.025	South	0.7	1.4
Opening, Window	3.9	South	0.7	1.4
Opening, Window	11.52	South	0.7	1.4
Opening, Window	6.4185	South	0.7	1.4
Opening, Window	0.7425	North	0.7	1.4
Opening, Window	0.7425	North	0.7	1.4
Opening, Window	2.025	North	0.7	1.4
Opening, Window	2.025	North	0.7	1.4
Opening, Window	2.85	North	0.7	1.4
Opening, Window	9.126	North	0.7	1.4
Opening, Window	11.52	North	0.7	1.4
Opening, Window	11.52	North	0.7	1.4
Opening, Window	6.84	North	0.7	1.4
Opening, Window	3.861	North	0.7	1.4
Opening, Window	1.144	North	0.7	1.4
Opening, Window	0.858	East	0.7	1.4
Opening, Window	0.858	East	0.7	1.4
Opening, Window	1.001	East	0.7	1.4
Opening, Window	2.03	East	0.7	1.4
Opening, Window	0.87	East	0.7	1.4
Opening, Window	0.9075	East	0.7	1.4
Opening, Window	2.565	North	0.7	1.4
Opening, Window	2.04	East	0.7	1.4
Opening, Window	3.12	East	0.7	1.4
Opening, Window	0.9075	East	0.7	1.4
Opening, velux	0.7874	East	0.7	1.3
Opening, velux	0.7874	East	0.7	1.3
Opening, velux	0.7874	East	0.7	1.3
Opening, velux	0.7874	West	0.7	1.3
Opening, velux	0.7874	West	0.7	1.3
Opening, velux	0.7874	West	0.7	1.3
Opening, rooflight	1.4	South	0.7	1.2
Opening, rooflight	1.4	South	0.7	1.2
Opening, rooflight	4.2	South	0.7	1.2

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	E24: Eaves (insulation at ceiling level - inverted)	SAP table default	0.15	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.051	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.036 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.061	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.032 (!)	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.057	
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.021 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.014 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.015 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.07	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.09	
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
Roof	R3: Jamb of roof window	SAP table default	0.24	
Roof	R11: Upstands or kerbs of rooflights	SAP table default	0.24	
External wall	E20: Exposed floor (normal)	SAP table default	0.32	
External wall	E21: Exposed floor (inverted)	SAP table default	0.32	
Roof	R4: Ridge (vaulted ceiling)	SAP table default	0.12	
Roof	R7: Flat ceiling (inverted)	SAP table default	0.12	
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	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity		
Efficiency	370.5%	
Emitter type	Both radiators and underfloor	
Flow temperature	45°C	
System type	Heat Pump	
Manufacturer	Mitsubishi Electric Europe B.V.	
Model	Ecodan 11.2 kW	
Commissioning		
Secondary heating system: Bioethanol heater		
Fuel	Bioethanol from any biomass source	
Efficiency	94.0%	
Commissioning		

5 Hot water

Cylinder/store - type: Cylinder		
Capacity	250 litres	
Declared heat loss	1.8 kWh/day	
Primary pipework insulated	Yes	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls

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

7 Lighting

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

8 Mechanical ventilation

System type: 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	2 kWp
Orientation	South
Pitch	Horizontal
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: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout



Plot Reference	5791				Issued on Date	27/05/2026	
Assessment Reference	v3			Plot Type Ref			
Plot Address	The Moorings, Reading, RG4 7EJ				SAP Version	10.2	
SAP Rating	81 B	DER	3.25	TER	8.82		
Environmental	96 A	% DER < TER				63.15	
CO ₂ Emissions (t/year)	1.39	DFEE	48.95	TFEE	49.68		
Compliance Check	See BREL	% DFEE < TFEE				1.48	
% DPER < TPER	28.11	DPER	34.22	TPER	47.60		
Assessor Details	Mr. Harry Davey				Assessor ID	R434-0001	
Client	..						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	228.6600 (1b)	x 3.0700 (2b)	= 701.9862 (1b) - (3b)
First floor	147.2500 (1c)	x 3.1300 (2c)	= 460.8925 (1c) - (3c)
Second floor	94.7900 (1d)	x 2.6200 (2d)	= 248.3498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	470.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1411.2285 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	1 * 20 = 20.0000 (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	10 * 10 = 100.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	120.0000 / (5) = 0.0850 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3350 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2848 (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	0.3631	0.3560	0.3489	0.3133	0.3061	0.2705	0.2705	0.2634	0.2848	0.3061	0.3204	0.3346 (22b)
Effective ac	0.5659	0.5634	0.5608	0.5491	0.5469	0.5366	0.5366	0.5347	0.5405	0.5469	0.5513	0.5560 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Door			6.7200	1.2000	8.0640		(26a)
Window			102.8500	1.3258	136.3542		(27)
rooflight			7.0000	1.1450	8.0153		(27a)
velux			4.7200	1.2357	5.8327		(27a)
Heatloss Floor 1			228.6600	0.1000	22.8660	110.0000	25152.6000 (28a)
exposed floor			2.8800	0.1500	0.4320	20.0000	57.6000 (28b)
External Wall 1	410.7400	107.0000	303.7400	0.1700	51.6358	60.0000	18224.4000 (29a)
Dormer	6.1000	2.5700	3.5300	0.1700	0.6001	9.0000	31.7700 (29a)
0.72	105.3000		105.3000	0.0900	9.4770	9.0000	947.7000 (29a)
cold pitch	90.9100	4.7200	86.1900	0.1300	11.2047	9.0000	775.7100 (30)
sedumroof	16.4800		16.4800	0.1200	1.9776	9.0000	148.3200 (30)
warm pitch	35.4000		35.4000	0.1100	3.8940	9.0000	318.6000 (30)
flat roof	40.2900	7.0000	33.2900	0.1200	3.9948	9.0000	299.6100 (30)
0.72	72.9600		72.9600	0.0900	6.5664	9.0000	656.6400 (30)
top roof	4.4500		4.4500	0.1800	0.8010	9.0000	40.0500 (30)
Total net area of external elements Aum(A, m ²)			1014.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	271.7155		(33)
Main dwelling							

Full SAP Calculation Printout



Internal Wall 1	120.6800	60.0000	7240.8000 (32c)
Internal Wall 2	35.6000	9.0000	320.4000 (32c)
Internal Floor 1	147.2500	110.0000	16197.5000 (32d)
Internal Floor 2	91.9100	18.0000	1654.3800 (32d)
Internal Ceiling 1	155.3500	9.0000	1398.1500 (32e)
Internal Ceiling 2	91.9100	9.0000	827.1900 (32e)

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

(28)...(30) + (32) + (32a)...(32e) = 74291.4200 (34)
157.8318 (35)

	Length	Psi-value	Total
K1 Element	14.1000	0.1500	2.1150
E24 Eaves (insulation at ceiling level - inverted)	27.4200	0.0510	1.3984
E14 Flat roof	59.4000	0.0360	2.1384
E16 Corner (normal)	30.5900	-0.0610	-1.8660
E17 Corner (inverted - internal area greater than external area)	58.1800	0.0320	1.8618
E11 Eaves (insulation at rafter level)	33.5400	0.0570	1.9118
E13 Gable (insulation at rafter level)	58.0800	0.0210	1.2197
E2 Other lintels (including other steel lintels)	55.2800	0.0140	0.7739
E3 Sill	105.1800	0.0150	1.5777
E4 Jamb	80.8600	0.0700	5.6602
E5 Ground floor (normal)	84.3700	0.0900	7.5933
E6 Intermediate floor within a dwelling	3.7200	0.2400	0.8928
R1 Head of roof window	3.7200	0.2400	0.8928
R2 Sill of roof window	15.2400	0.2400	3.6576
R3 Jamb of roof window	18.4000	0.2400	4.4160
R11 Upstands or kerbs of rooflights	8.5100	0.3200	2.7232
E20 Exposed floor (normal)	5.3000	0.3200	1.6960
E21 Exposed floor (inverted)	35.5100	0.1200	4.2612
R4 Ridge (vaulted ceiling)	16.0600	0.1200	1.9272
R7 Flat ceiling (inverted)	19.0000	0.1200	2.2800
R6 Flat ceiling			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

47.1310 (36)
(36a) = 0.0000
(33) + (36) + (36a) = 318.8465 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	263.5509	262.3588	261.1904	255.7023	254.6754	249.8955	249.8955	249.0103	251.7366	254.6754	256.7527	258.9243	(38)
Average = Sum(39)m / 12 =	582.3974	581.2054	580.0369	574.5488	573.5220	568.7420	568.7420	567.8568	570.5831	573.5220	575.5992	577.7708	(39)
	574.5438												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2373	1.2348	1.2323	1.2206	1.2184	1.2083	1.2083	1.2064	1.2122	1.2184	1.2229	1.2275	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.3538 (42)
Hot water usage for mixer showers													
110.6226	108.9602	106.5377	101.9027	98.4821	94.6676	92.4994	94.9036	97.5390	101.6347	106.3692	110.1988	(42a)	
Hot water usage for baths													
34.7206	34.2049	33.4788	32.1399	31.1374	30.0257	29.4253	30.1463	30.9314	32.1209	33.4874	34.6032	(42b)	
Hot water usage for other uses													
48.9767	47.1957	45.4147	43.6338	41.8528	40.0718	40.0718	41.8528	43.6338	45.4147	47.1957	48.9767	(42c)	
Average daily hot water use (litres/day)													178.7061 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
194.3199	190.3608	185.4312	177.6763	171.4723	164.7651	161.9965	166.9027	172.1042	179.1703	187.0523	193.7787	(44)	
Energy conte	307.7552	271.0713	285.0009	243.2300	230.8347	202.5980	195.9207	206.6604	212.2217	243.1324	266.4903	303.4106	(45)
Energy content (annual)										Total = Sum(45)m =	2968.3261		
Distribution loss (46)m = 0.15 x (45)m													
46.1633	40.6607	42.7501	36.4845	34.6252	30.3897	29.3881	30.9991	31.8332	36.4699	39.9735	45.5116	(46)	
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9720 (55)
Total storage loss													
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)	
If cylinder contains dedicated solar storage													
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	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	(61)	
Total heat required for water heating calculated for each month													
361.1496	319.2985	338.3953	294.9020	284.2291	254.2700	249.3151	260.0548	263.8937	296.5268	318.1623	356.8050	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h													
361.1496	319.2985	338.3953	294.9020	284.2291	254.2700	249.3151	260.0548	263.8937	296.5268	318.1623	356.8050	(64)	
12Total per year (kWh/year)													3597.0021 (64)
Electric shower(s)													3597 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
													0.0000 (64a)
Heat gains from water heating, kWh/month													
145.0441	128.7130	137.4783	122.2116	119.4680	108.7014	107.8592	111.4301	111.9013	123.5571	129.9456	143.5995	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.1957	326.8238	295.1957	305.0356	295.1957	305.0356	295.1957	295.1957	305.0356	295.1957	305.0356	295.1957	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	585.2585	591.3317	576.0275	543.4468	502.3195	463.6656	437.8425	431.7693	447.0735	479.6542	520.7815	559.4354	(68)
Pumps, fans	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)

Full SAP Calculation Printout



	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	(71)
Water heating gains (Table 5)	194.9518	191.5371	184.7827	169.7383	160.5753	150.9742	144.9720	149.7716	155.4185	166.0713	180.4800	(72)
Total internal gains	1148.7136	1183.0002	1129.3135	1091.5283	1031.3982	992.9830	951.3178	950.0443	980.8351	1014.2288	1079.6047	(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				54.9700	10.6334	0.6300	0.7000		0.7700		178.6362 (74)	
East				12.5900	19.6403	0.6300	0.7000		0.7700		75.5692 (76)	
South				35.2900	46.7521	0.6300	0.7000		0.7700		504.2249 (78)	
South				7.0000	26.0000	0.6300	0.7000		1.0000		72.2358 (82)	
East				2.3600	25.9287	0.6300	0.7000		1.0000		24.2870 (82)	
West				2.3600	25.9287	0.6300	0.7000		1.0000		24.2870 (82)	
Solar gains	879.2401	1562.2143	2307.7456	3142.8515	3777.5708	3863.0643	3677.4870	3186.9581	2594.3980	1772.5992	1064.9096	744.8066 (83)
Total gains	2027.9537	2745.2146	3437.0592	4234.3798	4808.9689	4856.0473	4628.8048	4137.0024	3575.2332	2786.8281	2144.5143	1865.7554 (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	35.4337	35.5064	35.5779	35.9178	35.9821	36.2845	36.2845	36.3410	36.1674	35.9821	35.8522	35.7175
alpha	3.3622	3.3671	3.3719	3.3945	3.3988	3.4190	3.4190	3.4227	3.4112	3.3988	3.3901	3.3812
util living area	0.9959	0.9886	0.9705	0.9181	0.8109	0.6523	0.5082	0.5759	0.8090	0.9584	0.9915	0.9969 (86)
Living	19.0915	19.3412	19.7107	20.1838	20.5697	20.7978	20.8742	20.8555	20.6619	20.1292	19.5191	19.0544
Non living	17.6363	17.9564	18.4266	19.0213	19.4757	19.7195	19.7818	19.7724	19.5941	18.9667	18.1919	17.5942
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	19.8903	19.8923	19.8943	19.9035	19.9053	19.9134	19.9134	19.9149	19.9103	19.9053	19.9018	19.8981 (88)
util rest of house	0.9950	0.9859	0.9633	0.8977	0.7642	0.5694	0.3957	0.4610	0.7433	0.9443	0.9892	0.9962 (89)
MIT 2	19.8903	19.8923	19.8943	19.9035	19.9053	19.9134	19.9134	19.9149	19.9103	19.9053	19.9018	19.8981 (90)
Living area fraction									fLA = Living area / (4) =			0.1876 (91)
MIT	20.0985	20.1001	20.1017	20.1093	20.1107	20.1173	20.1173	20.1185	20.1147	20.1107	20.1078	20.1048 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0985	20.1001	20.1017	20.1093	20.1107	20.1173	20.1173	20.1185	20.1147	20.1107	20.1078	20.1048 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9865	0.9648	0.9020	0.7738	0.5861	0.4179	0.4841	0.7572	0.9474	0.9897	0.9964	(94)
Useful gains	2018.1527	2708.0213	3316.1118	3819.2707	3721.4040	2846.0445	1934.2793	2002.5506	2707.2727	2640.1115	2122.3460	1858.9715	(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	9201.0048	8834.3984	7889.5081	6440.2724	4823.7109	3137.8993	2000.4153	2111.5662	3431.9017	5454.5850	7487.2943	9189.3550	(97)
Space heating kWh	5344.0420	4116.9254	3402.6068	1887.1212	820.1163	0.0000	0.0000	0.0000	0.0000	2093.9683	3862.7628	5453.8053	(98a)
Space heating requirement - total per year (kWh/year)												26981.3482	
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	5344.0420	4116.9254	3402.6068	1887.1212	820.1163	0.0000	0.0000	0.0000	0.0000	2093.9683	3862.7628	5453.8053	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												26981.3482	
Space heating per m2										(98c) / (4) =		57.3218	(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 %)												370.4531	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												94.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5344.0420	4116.9254	3402.6068	1887.1212	820.1163	0.0000	0.0000	0.0000	0.0000	2093.9683	3862.7628	5453.8053	(98)
Space heating efficiency (main heating system 1)	370.4531	370.4531	370.4531	370.4531	370.4531	0.0000	0.0000	0.0000	0.0000	370.4531	370.4531	370.4531	(210)
Space heating fuel (main heating system)	1442.5690	1111.3215	918.4986	509.4089	221.3819	0.0000	0.0000	0.0000	0.0000	565.2451	1042.7130	1472.1984	(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	361.1496	319.2985	338.3953	294.9020	284.2291	254.2700	249.3151	260.0548	263.8937	296.5268	318.1623	356.8050	(64)
Efficiency of water heater (217)m	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	101.8800	(216)
Fuel for water heating, kWh/month	354.4853	313.4064	332.1508	289.4602	278.9842	249.5779	244.7145	255.2560	259.0240	291.0550	312.2913	350.2208	(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)

Full SAP Calculation Printout



Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	80.8035	64.8235	58.3664	42.7617	33.0304	26.9861	30.1314	39.1660	50.8727	66.7478	75.3915	83.0492	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.7858	-49.2703	-89.9060	-122.1303	-144.5897	-133.4778	-130.5982	-114.4248	-88.1512	-62.4541	-33.2065	-22.6936	(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	-3.1646	-8.7905	-24.3724	-50.6697	-83.9671	-96.9222	-94.3874	-72.4680	-44.3288	-16.1123	-4.8095	-2.3048	(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												7283.3365	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												101.8800	
Water heating fuel used												3530.6263	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												652.1303	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1520.9856	(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												9945.1075	(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	7283.3365	0.1551	1129.8397 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3530.6263	0.1411	498.0916 (264)
Space and water heating			1627.9313 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	652.1303	0.1443	94.1226 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1018.6884	0.1316	-134.0092
PV Unit electricity exported	-502.2972	0.1179	-59.2033
Total			-193.2125 (269)
Total CO2, kg/year			1528.8414 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2500 (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	7283.3365	1.5743	11466.2088 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3530.6263	1.5217	5372.4203 (278)
Space and water heating			16838.6291 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	652.1303	1.5338	1000.2592 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1018.6884	1.4860	-1513.8029
PV Unit electricity exported	-502.2972	0.4321	-217.0456
Total			-1730.8485 (283)
Total Primary energy kWh/year			16108.0398 (286)
Dwelling Primary energy Rate (DPER)			34.2200 (287)

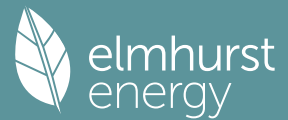
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	228.6600 (1b)	x 3.0700 (2b)	= 701.9862 (1b) - (3b)
First floor	147.2500 (1c)	x 3.1300 (2c)	= 460.8925 (1c) - (3c)
Second floor	94.7900 (1d)	x 2.6200 (2d)	= 248.3498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	470.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 1411.2285 (5)

2. Ventilation rate

Full SAP Calculation Printout



											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) =	0.0283 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.2783 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2366 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.3017	0.2957	0.2898	0.2603	0.2543	0.2248	0.2248	0.2188	0.2366	0.2543	0.2662	0.2780 (22b)	
Effective ac	0.5455	0.5437	0.5420	0.5339	0.5323	0.5253	0.5253	0.5239	0.5280	0.5323	0.5354	0.5386 (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			6.7200	1.0000	6.7200		(26a)
TER Opening Type			99.6100	1.1450	114.0573		(27)
TER Roof Window			4.5800	1.1450	6.4811		(27a)
TER Roof Light			6.7800	1.5918	13.7096		(27a)
Heatloss Floor 1			228.6600	0.1300	29.7258		(28a)
exposed floor			2.8800	0.1300	0.3744		(28b)
External Wall 1	410.7400	103.8400	306.9000	0.1800	55.2420		(29a)
Dormer	6.1000	2.4900	3.6100	0.1800	0.6498		(29a)
0.72	105.3000		105.3000	0.1800	18.9540		(29a)
cold pitch	90.9100	4.5800	86.3300	0.1100	9.4963		(30)
sedumroof	16.4800		16.4800	0.1100	1.8128		(30)
warm pitch	35.4000		35.4000	0.1100	3.8940		(30)
flat roof	40.2900	6.7800	33.5100	0.1100	3.6861		(30)
0.72	72.9600		72.9600	0.1100	8.0256		(30)
top roof	4.4500		4.4500	0.1100	0.4895		(30)
Total net area of external elements Aum(A, m2)			1014.1700				(31)
Fabric heat loss, W/K = Sum (A x U)					273.3182		(32)
					(26)...(30) + (32) =		273.3182 (33)

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

List of Thermal Bridges													157.8318 (35)
K1 Element													
E24 Eaves (insulation at ceiling level - inverted)						14.1000		Psi-value	0.2400		Total	3.3840	
E14 Flat roof						27.4200			0.0800			2.1936	
E16 Corner (normal)						59.4000			0.0900			5.3460	
E17 Corner (inverted - internal area greater than external area)						30.5900			-0.0900			-2.7531	
E11 Eaves (insulation at rafter level)						58.1800			0.0400			2.3272	
E13 Gable (insulation at rafter level)						33.5400			0.0800			2.6832	
E2 Other lintels (including other steel lintels)						58.0800			0.0500			2.9040	
E3 Sill						55.2800			0.0500			2.7640	
E4 Jamb						105.1800			0.0500			5.2590	
E5 Ground floor (normal)						80.8600			0.1600			12.9376	
E6 Intermediate floor within a dwelling						84.3700			0.0000			0.0000	
R1 Head of roof window						3.7200			0.0800			0.2976	
R2 Sill of roof window						3.7200			0.0600			0.2232	
R3 Jamb of roof window						15.2400			0.0800			1.2192	
R11 Upstands or kerbs of rooflights						18.4000			0.0800			1.4720	
E20 Exposed floor (normal)						8.5100			0.3200			2.7232	
E21 Exposed floor (inverted)						5.3000			0.3200			1.6960	
R4 Ridge (vaulted ceiling)						35.5100			0.0800			2.8408	
R7 Flat ceiling (inverted)						16.0600			0.0400			0.6424	
R6 Flat ceiling						19.0000			0.0600			1.1400	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												49.2999 (36)	
Point Thermal Bridges												(36a) =	0.0000
Total fabric heat loss												(33) + (36) + (36a) =	322.6181 (37)

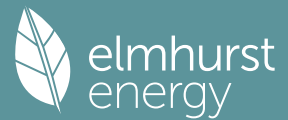
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	254.0414	253.2186	252.4121	248.6240	247.9153	244.6160	244.6160	244.0051	245.8869	247.9153	249.3491	250.8480 (38)
Average = Sum(39)m / 12 =	576.6595	575.8367	575.0302	571.2422	570.5335	567.2342	567.2342	566.6232	568.5050	570.5335	571.9672	573.4661 (39)
												571.2388
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2251	1.2234	1.2216	1.2136	1.2121	1.2051	1.2051	1.2038	1.2078	1.2121	1.2151	1.2183 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.3538 (42)
Hot water usage for mixer showers	80.4528	79.2438	77.4820	74.1110	71.6234	68.8492	67.2723	69.0208	70.9374	73.9161	77.3594	80.1446 (42a)
Hot water usage for baths	34.7206	34.2049	33.4788	32.1399	31.1374	30.0257	29.4253	30.1463	30.9314	32.1209	33.4874	34.6032 (42b)
Hot water usage for other uses	48.9767	47.1957	45.4147	43.6338	41.8528	40.0718	40.0718	41.8528	43.6338	45.4147	47.1957	48.9767 (42c)
Average daily hot water use (litres/day)												150.8905 (43)

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.1501	160.6444	156.3755	149.8847	144.6135	138.9467	136.7694	141.0199	145.5026	151.4518	158.0425	163.7245	(44)
Energy conte	259.9736	228.7555	240.3433	205.1847	194.6776	170.8512	165.4107	174.6121	179.4193	205.5186	225.1606	256.3529	(45)
Energy content (annual)	Total = Sum(45)m = 2506.2601												
Distribution loss (46)m = 0.15 x (45)m	38.9960	34.3133	36.0515	30.7777	29.2016	25.6277	24.8116	26.1918	26.9129	30.8278	33.7741	38.4529	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(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	314.8804	278.3487	295.2501	258.3203	249.5844	223.9868	220.3175	229.5189	232.5549	260.4254	278.2962	311.2597	(62)
WWHRS	-36.7797	-32.5282	-34.0617	-28.2044	-26.2855	-22.4927	-21.0833	-22.4200	-23.2718	-27.4349	-31.0804	-36.0986	(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	278.1007	245.8205	261.1884	230.1158	223.2989	201.4941	199.2342	207.0989	209.2831	232.9905	247.2157	275.1611	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 2811.0019 (64)												2811 (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	130.3667	115.7358	123.8396	110.7324	108.6557	99.3165	98.9245	101.9840	102.1654	112.2604	117.3744	129.1628	(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	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	295.1957	326.8238	295.1957	305.0356	295.1957	305.0356	295.1957	295.1957	305.0356	295.1957	305.0356	295.1957	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	585.2585	591.3317	576.0275	543.4468	502.3195	463.6656	437.8425	431.7693	447.0735	479.6542	520.7815	559.4354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	(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)	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	(71)
Water heating gains (Table 5)	175.2240	172.2259	166.4510	153.7950	146.0427	137.9396	132.9630	137.0752	141.8964	150.8876	163.0200	173.6059	(72)
Total internal gains	1131.9858	1166.6890	1113.9819	1078.5850	1019.8655	979.9484	939.3088	937.3478	967.3130	1002.0451	1065.1446	1104.5446	(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				53.2200	10.6334	0.6300	0.7000	0.7700	172.9492 (74)				
East				12.2100	19.6403	0.6300	0.7000	0.7700	73.2883 (76)				
South				34.1800	46.7521	0.6300	0.7000	0.7700	488.3652 (78)				
East				2.2900	25.9287	0.6300	0.7000	1.0000	23.5666 (82)				
West				2.2900	25.9287	0.6300	0.7000	1.0000	23.5666 (82)				
South				6.7800	26.0000	0.6300	0.7000	1.0000	69.9655 (82)				
Solar gains	851.7015	1513.3124	2235.5500	3044.5520	3659.4040	3742.2081	3562.4433	3087.2763	2513.2466	1717.1262	1031.5614	721.4744	(83)
Total gains	1983.6873	2680.0014	3349.5319	4123.1370	4679.2694	4722.1565	4501.7521	4024.6242	3480.5596	2719.1713	2096.7061	1826.0190	(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	35.7863	35.8374	35.8877	36.1257	36.1705	36.3809	36.3809	36.4202	36.2996	36.1705	36.0799	35.9856	
alpha	3.3858	3.3892	3.3925	3.4084	3.4114	3.4254	3.4254	3.4280	3.4200	3.4114	3.4053	3.3990	
util living area	0.9962	0.9894	0.9724	0.9227	0.8193	0.6638	0.5191	0.5874	0.8176	0.9609	0.9921	0.9972	(86)
MIT	18.5865	18.9118	19.3964	20.0173	20.5342	20.8428	20.9496	20.9231	20.6589	19.9495	19.1443	18.5320	(87)
Th 2	19.9000	19.9014	19.9027	19.9091	19.9103	19.9159	19.9159	19.9170	19.9138	19.9103	19.9079	19.9054	(88)
util rest of house	0.9953	0.9869	0.9657	0.9033	0.7737	0.5810	0.4053	0.4716	0.7533	0.9476	0.9899	0.9965	(89)
MIT 2	17.0589	17.4752	18.0915	18.8684	19.4785	19.8054	19.8930	19.8785	19.6362	18.7999	17.7782	16.9924	(90)
Living area fraction	17.3455	17.7447	18.3363	19.0840	19.6766	20.0000	20.0913	20.0745	19.8281	19.0156	18.0345	17.2813	(91)
MIT	17.3455	17.7447	18.3363	19.0840	19.6766	20.0000	20.0913	20.0745	19.8281	19.0156	18.0345	17.2813	(92)
Temperature adjustment	17.3455	17.7447	18.3363	19.0840	19.6766	20.0000	20.0913	20.0745	19.8281	19.0156	18.0345	17.2813	(93)
adjusted MIT	17.3455	17.7447	18.3363	19.0840	19.6766	20.0000	20.0913	20.0745	19.8281	19.0156	18.0345	17.2813	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1967.6271	2624.5955	3188.8996	3647.3738	3567.6590	2776.5648	1911.9816	1971.1202	2601.1855	2534.6253	2062.7080	1814.6583	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	7522.8331	7396.4561	6806.2416	5817.5283	4550.8968	3063.0904	1980.3750	2082.0498	3256.4389	4801.3923	6254.1848	7501.6650	(97)

Full SAP Calculation Printout



Space heating kWh	4133.0732	3206.6903	2691.3025	1562.5112	731.5290	0.0000	0.0000	0.0000	0.0000	1686.4746	3017.8633	4231.1330 (98a)
Space heating requirement - total per year (kWh/year)												21260.5771
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	4133.0732	3206.6903	2691.3025	1562.5112	731.5290	0.0000	0.0000	0.0000	0.0000	1686.4746	3017.8633	4231.1330 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												21260.5771
Space heating per m2											(98c) / (4) =	45.1680 (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	4133.0732	3206.6903	2691.3025	1562.5112	731.5290	0.0000	0.0000	0.0000	0.0000	1686.4746	3017.8633	4231.1330 (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)	4477.8692	3474.2040	2915.8207	1692.8616	792.5557	0.0000	0.0000	0.0000	0.0000	1827.1664	3269.6243	4584.1094 (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 requirement	278.1007	245.8205	261.1884	230.1158	223.2989	201.4941	199.2342	207.0989	209.2831	232.9905	247.2157	275.1611 (64)
Efficiency of water heater	88.1731	88.0926	87.9228	87.5327	86.5180	79.8000	79.8000	79.8000	79.8000	87.6008	88.0481	79.8000 (216)
Fuel for water heating, kWh/month	315.4033	279.0478	297.0656	262.8912	258.0952	252.4988	249.6669	259.5224	262.2595	265.9686	280.7734	312.0001 (219)
Space cooling fuel requirement	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)
(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	61.3358	49.2059	44.3044	32.4593	25.0725	20.4845	22.8720	29.7299	38.6162	50.6665	57.2277	63.0406 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-168.6438	-217.9977	-287.3491	-295.0174	-295.7409	-267.6804	-263.4865	-258.5899	-248.4006	-233.8346	-177.7646	-148.1427 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-166.1594	-337.8851	-651.6181	-951.6437	-1233.8447	-1231.7192	-1217.9760	-1042.8927	-779.7884	-474.7088	-218.8133	-132.3957 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												23034.2114 (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												3295.1927 (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)												495.0154 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-11302.0934 (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												15608.3260 (238)

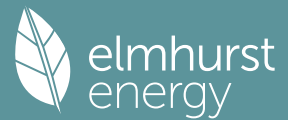
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	23034.2114	0.2100	4837.1844 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3295.1927	0.2100	691.9905 (264)
Space and water heating			5529.1749 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	495.0154	0.1443	71.4460 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2862.6482	0.1366	-390.9851
PV Unit electricity exported	-8439.4452	0.1267	-1069.5190
Total			-1460.5041 (269)
Total CO2, kg/year			4152.0460 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.8200 (273)

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

Energy Primary energy factor Primary energy

Full SAP Calculation Printout



Space heating - main system 1	kWh/year	kg CO2/kWh	kWh/year
Total CO2 associated with community systems	23034.2114	1.1300	26028.6589 (275)
Water heating (other fuel)			0.0000 (473)
Space and water heating	3295.1927	1.1300	3723.5678 (278)
Pumps, fans and electric keep-hot	86.0000	1.5128	29752.2266 (279)
Energy for lighting	495.0154	1.5338	130.1008 (281)
			759.2711 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2862.6482	1.5049	-4307.9732
PV Unit electricity exported	-8439.4452	0.4652	-3926.1669
Total			-8234.1401 (283)
Total Primary energy kWh/year			22407.4584 (286)
Target Primary Energy Rate (TPER)			47.6000 (287)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	228.6600 (1b)	x 3.0700 (2b)	= 701.9862 (1b) - (3b)
First floor	147.2500 (1c)	x 3.1300 (2c)	= 460.8925 (1c) - (3c)
Second floor	94.7900 (1d)	x 2.6200 (2d)	= 248.3498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	470.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1411.2285 (5)

2. Ventilation rate

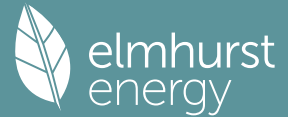
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	40.0000 / (5) = 0.0283 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2783	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2366 (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	0.3017	0.2957	0.2898	0.2603	0.2543	0.2248	0.2248	0.2188	0.2366	0.2543	0.2662	0.2780 (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	0.5455	0.5437	0.5420	0.5339	0.5323	0.5253	0.5253	0.5239	0.5280	0.5323	0.5354	0.5386 (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							
Door			6.7200	1.2000	8.0640		(26a)
Window			102.8500	1.3258	136.3542		(27)
rooflight			7.0000	1.1450	8.0153		(27a)
velux			4.7200	1.2357	5.8327		(27a)
Heatloss Floor 1			228.6600	0.1000	22.8660	110.0000	25152.6000 (28a)
exposed floor			2.8800	0.1500	0.4320	20.0000	57.6000 (28b)
External Wall 1	410.7400	107.0000	303.7400	0.1700	51.6358	60.0000	18224.4000 (29a)
Dormer	6.1000	2.5700	3.5300	0.1700	0.6001	9.0000	31.7700 (29a)
0.72	105.3000		105.3000	0.0900	9.4770	9.0000	947.7000 (29a)
cold pitch	90.9100	4.7200	86.1900	0.1300	11.2047	9.0000	775.7100 (30)
sedumroof	16.4800		16.4800	0.1200	1.9776	9.0000	148.3200 (30)
warm pitch	35.4000		35.4000	0.1100	3.8940	9.0000	318.6000 (30)
flat roof	40.2900	7.0000	33.2900	0.1200	3.9948	9.0000	299.6100 (30)
0.72	72.9600		72.9600	0.0900	6.5664	9.0000	656.6400 (30)
top roof	4.4500		4.4500	0.1800	0.8010	9.0000	40.0500 (30)
Total net area of external elements Aum(A, m2)			1014.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	271.7155		(33)
Main dwelling							
Internal Wall 1			120.6800			60.0000	7240.8000 (32c)
Internal Wall 2			35.6000			9.0000	320.4000 (32c)
Internal Floor 1			147.2500			110.0000	16197.5000 (32d)
Internal Floor 2			91.9100			18.0000	1654.3800 (32d)
Internal Ceiling 1			155.3500			9.0000	1398.1500 (32e)
Internal Ceiling 2			91.9100			9.0000	827.1900 (32e)

Full SAP Calculation Printout



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

(28)...(30) + (32) + (32a)...(32e) = 74291.4200 (34)
157.8318 (35)

	Length	Psi-value	Total
K1 Element			
E24 Eaves (insulation at ceiling level - inverted)	14.1000	0.1500	2.1150
E14 Flat roof	27.4200	0.0510	1.3984
E16 Corner (normal)	59.4000	0.0360	2.1384
E17 Corner (inverted - internal area greater than external area)	30.5900	-0.0610	-1.8660
E11 Eaves (insulation at rafter level)	58.1800	0.0320	1.8618
E13 Gable (insulation at rafter level)	33.5400	0.0570	1.9118
E2 Other lintels (including other steel lintels)	58.0800	0.0210	1.2197
E3 Sill	55.2800	0.0140	0.7739
E4 Jamb	105.1800	0.0150	1.5777
E5 Ground floor (normal)	80.8600	0.0700	5.6602
E6 Intermediate floor within a dwelling	84.3700	0.0900	7.5933
R1 Head of roof window	3.7200	0.2400	0.8928
R2 Sill of roof window	3.7200	0.2400	0.8928
R3 Jamb of roof window	15.2400	0.2400	3.6576
R11 Upstands or kerbs of rooflights	18.4000	0.2400	4.4160
E20 Exposed floor (normal)	8.5100	0.3200	2.7232
E21 Exposed floor (inverted)	5.3000	0.3200	1.6960
R4 Ridge (vaulted ceiling)	35.5100	0.1200	4.2612
R7 Flat ceiling (inverted)	16.0600	0.1200	1.9272
R6 Flat ceiling	19.0000	0.1200	2.2800
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			47.1310 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	318.8465 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25\text{m} \times 5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	254.0414	253.2186	252.4121	248.6240	247.9153	244.6160	244.6160	244.0051	245.8869	247.9153	249.3491	250.8480	(38)
Heat transfer coeff	572.8879	572.0651	571.2586	567.4705	566.7618	563.4625	563.4625	562.8516	564.7334	566.7618	568.1956	569.6945	(39)
Average = $\text{Sum}(39)\text{m} / 12 =$												567.4671	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2171	1.2153	1.2136	1.2056	1.2041	1.1971	1.1971	1.1958	1.1998	1.2041	1.2071	1.2103	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.3538 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	34.7206	34.2049	33.4788	32.1399	31.1374	30.0257	29.4253	30.1463	30.9314	32.1209	33.4874	34.6032	(42b)
Hot water usage for other uses	48.9767	47.1957	45.4147	43.6338	41.8528	40.0718	40.0718	41.8528	43.6338	45.4147	47.1957	48.9767	(42c)
Average daily hot water use (litres/day)												76.7157	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	83.6972	81.4006	78.8935	75.7737	72.9902	70.0975	69.4971	71.9991	74.5652	77.5357	80.6831	83.5799	(44)
Energy content (annual)	132.5560	115.9134	121.2564	103.7304	98.2588	86.1931	84.0507	89.1499	91.9463	105.2152	114.9478	130.8659	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	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):	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)
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	(57)
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	(59)
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	(61)
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	(62)
Total heat required for water heating calculated for each month	112.6726	98.5264	103.0679	88.1708	83.5200	73.2641	71.4431	75.7775	78.1544	89.4329	97.7057	111.2360	(63a)
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	(63b)
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	(63c)
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	(63d)
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	(64)
Output from w/h	112.6726	98.5264	103.0679	88.1708	83.5200	73.2641	71.4431	75.7775	78.1544	89.4329	97.7057	111.2360	(64)
12Total per year (kWh/year)												1082.9713	(64)
Electric shower(s)	64.4293	57.4070	62.6863	59.8208	60.9433	58.1340	60.0718	60.9433	59.8208	62.6863	61.5076	64.4293	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												732.8797	(64a)
Heat gains from water heating, kWh/month	44.2755	38.9834	41.4386	36.9979	36.1158	32.8495	32.8787	34.1802	34.4938	38.0298	39.8033	43.9163	(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	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	295.1957	326.8238	295.1957	305.0356	295.1957	305.0356	295.1957	295.1957	305.0356	295.1957	305.0356	295.1957	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	585.2585	591.3317	576.0275	543.4468	502.3195	463.6656	437.8425	431.7693	447.0735	479.6542	520.7815	559.4354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	(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)	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	(71)
Water heating gains (Table 5)	59.5100	58.0110	55.6970	51.3860	48.5428	45.6243	44.1918	45.9411	47.9080	51.1153	55.2824	59.0273	(72)
Total internal gains	1013.2719	1049.4741	1000.2278	973.1759	919.3656	887.6332	850.5376	846.2137	873.3247	899.2728	954.4070	986.9660	(73)

6. Solar gains

Full SAP Calculation Printout



[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	54.9700	10.6334	0.6300	0.7000	0.7700	178.6362 (74)
East	12.5900	19.6403	0.6300	0.7000	0.7700	75.5692 (76)
South	35.2900	46.7521	0.6300	0.7000	0.7700	504.2249 (78)
South	7.0000	26.0000	0.6300	0.7000	1.0000	72.2358 (82)
East	2.3600	25.9287	0.6300	0.7000	1.0000	24.2870 (82)
West	2.3600	25.9287	0.6300	0.7000	1.0000	24.2870 (82)

Solar gains	879.2401	1562.2143	2307.7456	3142.8515	3777.5708	3863.0643	3677.4870	3186.9581	2594.3980	1772.5992	1064.9096	744.8066 (83)
Total gains	1892.5120	2611.6884	3307.9735	4116.0274	4696.9364	4750.6975	4528.0246	4033.1719	3467.7227	2671.8721	2019.3166	1731.7726 (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	36.0219	36.0737	36.1246	36.3658	36.4112	36.6244	36.6244	36.6642	36.5420	36.4112	36.3194	36.2238
alpha	3.4015	3.4049	3.4083	3.4244	3.4274	3.4416	3.4416	3.4443	3.4361	3.4274	3.4213	3.4149
util living area	0.9968	0.9902	0.9732	0.9225	0.8165	0.6588	0.5141	0.5839	0.8174	0.9626	0.9930	0.9976 (86)
MIT	18.5731	18.9060	19.3986	20.0274	20.5449	20.8487	20.9519	20.9256	20.6630	19.9467	19.1334	18.5175 (87)
Th 2	19.9063	19.9077	19.9091	19.9155	19.9167	19.9223	19.9223	19.9234	19.9202	19.9167	19.9143	19.9118 (88)
util rest of house	0.9960	0.9878	0.9667	0.9031	0.7708	0.5764	0.4016	0.4691	0.7534	0.9497	0.9910	0.9970 (89)
MIT 2	17.6770	18.0094	18.4980	19.1126	19.5882	19.8395	19.9053	19.8944	19.7062	19.0472	18.2418	17.6252 (90)
Living area fraction	17.8451	18.1776	18.6669	19.2842	19.7677	20.0289	20.1017	20.0879	fLA = Living area / (4) =	19.2160	18.4091	0.1876 (91)
MIT	17.8451	18.1776	18.6669	19.2842	19.7677	20.0289	20.1017	20.0879	19.8857	19.2160	18.4091	17.7926 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8451	18.1776	18.6669	19.2842	19.7677	20.0289	20.1017	20.0879	19.8857	19.2160	18.4091	17.7926 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9938	0.9825	0.9566	0.8891	0.7636	0.5852	0.4213	0.4879	0.7510	0.9384	0.9869	0.9953 (94)
Useful gains	1880.7077	2566.0615	3164.5218	3659.5306	3586.7057	2780.0668	1907.6110	1967.8526	2604.2591	2507.3093	1992.7693	1723.6837 (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	7759.8274	7595.6595	6950.4724	5892.7393	4572.4491	3058.9606	1973.0718	2075.7265	3267.3901	4883.2186	6425.7809	7743.6566 (97)
Space heating kWh	4374.0650	3379.8899	2816.7473	1607.9102	733.3931	0.0000	0.0000	0.0000	0.0000	1767.6765	3191.7684	4478.8598 (98a)
Space heating requirement - total per year (kWh/year)												22350.3101
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	4374.0650	3379.8899	2816.7473	1607.9102	733.3931	0.0000	0.0000	0.0000	0.0000	1767.6765	3191.7684	4478.8598 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												22350.3101
Space heating per m2										(98c) / (4) =		47.4831 (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	5296.5479	4169.6228	4277.6719	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7718	0.8400	0.7909	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4088.0414	3502.5104	3383.0302	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5255.4677	5008.7144	4459.7011	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	840.5469	1120.6158	801.0432	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	210.1367	280.1539	200.2608	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												690.5515 (107)
Energy for space heating												47.4831 (99)
Energy for space cooling												1.4671 (108)
Total												48.9502 (109)
Fabric Energy Efficiency (DFEE)												49.0 (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	228.6600 (1b)	x 3.0700 (2b)	= 701.9862 (1b) - (3b)
First floor	147.2500 (1c)	x 3.1300 (2c)	= 460.8925 (1c) - (3c)
Second floor	94.7900 (1d)	x 2.6200 (2d)	= 248.3498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	470.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	1411.2285 (5)

Full SAP Calculation Printout



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) =	0.0283 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.2783 (18)		
Number of sides sheltered											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2366 (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	0.3017	0.2957	0.2898	0.2603	0.2543	0.2248	0.2248	0.2188	0.2366	0.2543	0.2662	0.2780	(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	0.5455	0.5437	0.5420	0.5339	0.5323	0.5253	0.5253	0.5239	0.5280	0.5323	0.5354	0.5386	(25)

Full SAP Calculation Printout



Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	34.7206	34.2049	33.4788	32.1399	31.1374	30.0257	29.4253	30.1463	30.9314	32.1209	33.4874	34.6032 (42b)
Hot water usage for other uses	48.9767	47.1957	45.4147	43.6338	41.8528	40.0718	40.0718	41.8528	43.6338	45.4147	47.1957	48.9767 (42c)
Average daily hot water use (litres/day)												76.7157 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	83.6972	81.4006	78.8935	75.7737	72.9902	70.0975	69.4971	71.9991	74.5652	77.5357	80.6831	83.5799 (44)
Distribution loss (46)m = 0.15 x (45)m	132.5560	115.9134	121.2564	103.7304	98.2588	86.1931	84.0507	89.1499	91.9463	105.2152	114.9478	130.8659 (45)
Water storage loss (or HIU 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 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	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	112.6726	98.5264	103.0679	88.1708	83.5200	73.2641	71.4431	75.7775	78.1544	89.4329	97.7057	111.2360 (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	112.6726	98.5264	103.0679	88.1708	83.5200	73.2641	71.4431	75.7775	78.1544	89.4329	97.7057	111.2360 (64)
12Total per year (kWh/year)												1082.9713 (64)
Electric shower(s)	64.4293	57.4070	62.6863	59.8208	60.9433	58.1340	60.0718	60.9433	59.8208	62.6863	61.5076	64.4293 (64a)
Heat gains from water heating, kWh/month	44.2755	38.9834	41.4386	36.9979	36.1158	32.8495	32.8787	34.1802	34.4938	38.0298	39.8033	43.9163 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 732.8797 (64a)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920	167.6920 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	295.1957	326.8238	295.1957	305.0356	295.1957	305.0356	295.1957	295.1957	305.0356	295.1957	305.0356	295.1957 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	585.2585	591.3317	576.0275	543.4468	502.3195	463.6656	437.8425	431.7693	447.0735	479.6542	520.7815	559.4354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692	39.7692 (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)	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536	-134.1536 (71)
Water heating gains (Table 5)	59.5100	58.0110	55.6970	51.3860	48.5428	45.6243	44.1918	45.9411	47.9080	51.1153	55.2824	59.0273 (72)
Total internal gains	1013.2719	1049.4741	1000.2278	973.1759	919.3656	887.6332	850.5376	846.2137	873.3247	899.2728	954.4070	986.9660 (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				53.2200	10.6334		0.6300		0.7000		0.7700		172.9492 (74)
East				12.2100	19.6403		0.6300		0.7000		0.7700		73.2883 (76)
South				34.1800	46.7521		0.6300		0.7000		0.7700		488.3652 (78)
East				2.2900	25.9287		0.6300		0.7000		1.0000		23.5666 (82)
West				2.2900	25.9287		0.6300		0.7000		1.0000		23.5666 (82)
South				6.7800	26.0000		0.6300		0.7000		1.0000		69.9655 (82)
Solar gains	851.7015	1513.3124	2235.5500	3044.5520	3659.4040	3742.2081	3562.4433	3087.2763	2513.2466	1717.1262	1031.5614		721.4744 (83)
Total gains	1864.9734	2562.7865	3235.7778	4017.7280	4578.7695	4629.8413	4412.9809	3933.4901	3386.5713	2616.3990	1985.9685		1708.4404 (84)

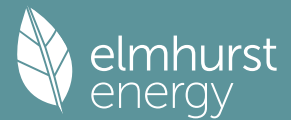
7. Mean internal temperature (heating season)

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	35.7863	35.8374	35.8877	36.1257	36.1705	36.3809	36.3809	36.4202	36.2996	36.1705	36.0799	35.9856
alpha	3.3858	3.3892	3.3925	3.4084	3.4114	3.4254	3.4254	3.4280	3.4200	3.4114	3.4053	3.3990
util living area	0.9969	0.9907	0.9749	0.9275	0.8266	0.6725	0.5276	0.5976	0.8269	0.9648	0.9933	0.9977 (86)
MIT	18.5496	18.8763	19.3641	19.9925	20.5188	20.8362	20.9470	20.9189	20.6446	19.9215	19.1103	18.4952 (87)
Th 2	19.9000	19.9014	19.9027	19.9091	19.9103	19.9159	19.9159	19.9170	19.9138	19.9103	19.9079	19.9054 (88)
util rest of house	0.9961	0.9885	0.9688	0.9089	0.7820	0.5898	0.4127	0.4811	0.7642	0.9526	0.9914	0.9971 (89)
MIT 2	17.6491	17.9754	18.4597	19.0752	19.5612	19.8257	19.8971	19.8851	19.6867	19.0183	18.2145	17.5986 (90)
Living area fraction	17.8181	18.1445	18.6294	19.2473	19.7409	20.0153	20.0941	20.0791	19.8664	19.1878	18.3826	17.7668 (91)
MIT	17.8181	18.1445	18.6294	19.2473	19.7409	20.0153	20.0941	20.0791	19.8664	19.1878	18.3826	17.7668 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8181	18.1445	18.6294	19.2473	19.7409	20.0153	20.0941	20.0791	19.8664	19.1878	18.3826	17.7668 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9940	0.9834	0.9590	0.8949	0.7741	0.5981	0.4327	0.4999	0.7610	0.9415	0.9874	0.9955 (94)

Full SAP Calculation Printout



Useful gains	1853.7625	2520.1953	3103.1091	3595.5923	3544.2312	2768.9037	1909.4940	1966.3935	2577.2352	2463.3581	1960.9772	1700.7208	(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													
Space heating	7795.3299	7626.6418	6974.7759	5910.8291	4587.6016	3071.7396	1981.9558	2084.6497	3278.2458	4899.6279	6453.2732	7780.1256	(97)
Space heating kWh													
Space heating requirement - total per year (kWh/year)	4420.5261	3431.5321	2880.5201	1666.9705	776.2676	0.0000	0.0000	0.0000	0.0000	1812.5847	3234.4532	4523.0771	(98a)
Solar heating kWh													
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	4420.5261	3431.5321	2880.5201	1666.9705	776.2676	0.0000	0.0000	0.0000	0.0000	1812.5847	3234.4532	4523.0771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												22745.9313	
Space heating per m2												(98c) / (4) =	48.3236 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	5332.0013	4197.5329	4306.3363	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7580	0.8284	0.7778	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4041.5767	3477.0385	3349.3471	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh													
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	775.5921	1042.7473	742.1093	0.0000	0.0000	0.0000	0.0000	(104)
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	(105)
Space cooling kWh													
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	193.8980	260.6868	185.5273	0.0000	0.0000	0.0000	0.0000	(107)
Energy for space heating													640.1122 (107)
Energy for space cooling													48.3236 (99)
Total													1.3599 (108)
Fabric Energy Efficiency (TFEE)													49.6835 (109)
													49.7 (109)