

Building Regulations England Part L (BREL) Compliance Report

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

Date: Wed 13 Dec 2023 11:46:39

Project Information			
Assessed By	Thomas McMahon	Building Type	House, Detached
OCDEA Registration	EES/022313	Assessment Date	2023-12-13

Dwelling Details			
Assessment Type	As designed	Total Floor Area	282 m ²
Site Reference	Beauchamps Cottage	Plot Reference	ASHP
Address	Beauchamps Cottage, Wyddial, SG9 0EP		

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	6.96 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	3.47 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	37.58 kWh _{PE} /m ²	
Dwelling primary energy	35.86 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	41.2 kWh/m ²	
Dwelling fabric energy efficiency	38.7 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 (2) (0.18)	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	0.14	Roof (1) (0.16)	OK
Windows, doors, and roof windows	1.6	1.2	E G (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

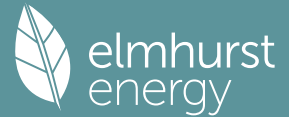
2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	92.84	0.15
Exposed wall: Walls (2)	5.8	0.18
Exposed wall: Walls (3)	49.59	0.12 (!)
Exposed wall: Walls (4)	43.79	0.17
Ground floor: Ground Floor, Ground Floor	171.61	0.11
Exposed roof: Roof (1)	87.01	0.16
Exposed roof: Roof (2)	11.13	0.12
Exposed roof: Roof (3)	76.22	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
E G, Glazing	19.89	East	0.7	1.2
E G, Glazing	3.67	East	0.7	1.2
E D, Doors	1.91	East	N/A	1.2
E RW, Roof Windows	4.79	East	0.7	1.2
W G, Glazing	10.1	West	0.7	1.2
W RW, Roof Windows	4.37	West	0.7	1.2
N G, Glazing	1.62	North	0.7	1.2
N D, Doors	1.95	North	N/A	1.2
S G, Glazing	15.38	South	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling : Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.021 (!)	RCD - thermally broken
External wall	E2: Other lintels (including other steel lintels)	SAP table default	1	Dormer
External wall	E3: Sill	Calculated by person with suitable expertise	0.024 (!)	RCD
External wall	E3: Sill	SAP table default	0.1	Dormer
External wall	E4: Jamb	Calculated by person with suitable expertise	0.019 (!)	RCD
External wall	E4: Jamb	SAP table default	0.1	Dormer
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.045	RCD
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	RCD
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.051	RCD
External wall	E24: Eaves (insulation at ceiling level - inverted)	SAP table default	0.15	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.018 (!)	RCD
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.029 (!)	RCD
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.034 (!)	RCD
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.037 (!)	RCD
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.079	RCD
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.058	Keylite
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.049	Keylite
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.058	Keylite
Roof	R6: Flat ceiling	SAP table default	0.12	
Roof	R7: Flat ceiling (inverted)	SAP table default	0.12	
Roof	R8: Roof to wall (rafter)	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	254.4%			
Emitter type	Both radiators and underfloor			
Flow temperature	55°C			
System type	Heat Pump			
Manufacturer	Mitsubishi Electric Europe B.V.			
Model	Ecodan 14.0 kW			
Commissioning				
Secondary heating system : Closed room heater				
Fuel	Wood logs			
Efficiency	65.0%			
Commissioning				

5 Hot water		
Cylinder/store - type: Cylinder		
Capacity	300 litres	
Declared heat loss	2.5 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		
<i>Minimum permitted light source efficacy</i>	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
<i>Maximum permitted specific fan power</i>	N/A	
Specific fan power	N/A	N/A
<i>Minimum permitted heat recovery efficiency</i>	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Beauchamps Cottage		Issued on Date	13/12/2023	
Assessment Reference	ASHP	Prop Type Ref	New build		
Property	Beauchamps Cottage, Wyddial, SG9 0EP				
SAP Rating	81 B	DER	3.47	TER	6.96
Environmental	96 A	% DER < TER			50.14
CO ₂ Emissions (t/year)	0.94	DFEE	38.69	TFEE	41.25
Compliance Check	See BREL	% DFEE < TFEE			6.19
% DPER < TPER	4.57	DPER	35.86	TPER	37.58
Assessor Details	Mr. Thomas McMahon			Assessor ID	R863-0001
Client	,				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	171.6100 (1b)	2.5800 (2b)	442.7538 (1b) - (3b)
First floor	109.9400 (1c)	2.3800 (2c)	261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	704.4110 (5)

2. Ventilation rate

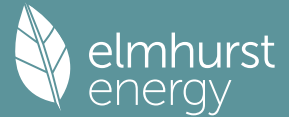
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	7 * 10 = 70.0000 (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) =	90.0000 / (5) = 0.1278 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3778 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3494 (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	0.4455	0.4368	0.4281	0.3844	0.3756	0.3320	0.3320	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843 (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
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076		(27)
Doors			3.8600	1.2000	4.6320		(26a)
E RW			4.7900	1.1450	5.4847		(27a)
W RW			4.3700	1.1450	5.0038		(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500 (28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000 (29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000 (29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100 (29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000 (29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900 (30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700 (30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800 (30)
Total net area of external elements Aum (A, m ²)			601.6700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.0118		(33)
Block			135.2000			75.0000	10140.0000 (32c)
Stud			159.1600			9.0000	1432.4400 (32c)
Internal Floor 1			109.9400			18.0000	1978.9200 (32d)
Internal Ceiling 1			109.9400			9.0000	989.4600 (32e)

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Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 37677.1200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.8204 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)		29.1700	0.0210	0.6126
E2 Other lintels (including other steel lintels)		4.4500	1.0000	4.4500
E3 Sill		12.1900	0.0240	0.2926
E3 Sill		4.4500	0.1000	0.4450
E4 Jamb		50.9000	0.0190	0.9671
E4 Jamb		3.2800	0.1000	0.3280
E5 Ground floor (normal)		64.4000	0.0450	2.8980
E6 Intermediate floor within a dwelling		40.0900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)		5.0000	0.0510	0.2550
E24 Eaves (insulation at ceiling level - inverted)		11.2900	0.1500	1.6935
E11 Eaves (insulation at rafter level)		46.4200	0.0180	0.8356
E12 Gable (insulation at ceiling level)		14.7900	0.0290	0.4289
E13 Gable (insulation at rafter level)		10.8500	0.0340	0.3689
E16 Corner (normal)		21.4000	0.0370	0.7918
E17 Corner (inverted - internal area greater than external area)		7.0500	-0.0790	-0.5569
R1 Head of roof window		6.5400	0.0580	0.3793
R2 Sill of roof window		6.5400	0.0490	0.3205
R3 Jamb of roof window		19.6200	0.0580	1.1380
R6 Flat ceiling		40.4000	0.1200	4.8480
R7 Flat ceiling (inverted)		9.0800	0.1200	1.0896
R8 Roof to wall (rafter)		12.4600	0.1200	1.4952

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 23.0805 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 167.0923 (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	139.2985	138.4026	137.5245	133.4000	132.6283	129.0360	129.0360	128.3707	130.4197	132.6283	134.1894	135.8215 (38)
Average = Sum(39)m / 12 =	306.3908	305.4949	304.6168	300.4923	299.7206	296.1283	296.1283	295.4630	297.5120	299.7206	301.2817	302.9138 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0882	1.0850	1.0819	1.0673	1.0645	1.0518	1.0518	1.0494	1.0567	1.0645	1.0701	1.0759 (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													3.1079 (42)
Hot water usage for mixer showers													76.3299
Hot water usage for baths													32.9476
Hot water usage for other uses													46.4585
Average daily hot water use (litres/day)													143.1562 (43)
Daily hot water use	155.7360	152.4102	148.3602	142.2021	137.2012	131.8248	129.7590	133.7915	138.0444	143.6885	149.9415	155.3321 (44)	
Energy content (annual)	246.6477	217.0300	228.0240	194.6675	184.6991	162.0940	156.9322	165.6618	170.2225	194.9840	213.6191	243.2126 (45)	
Distribution loss (46)m = 0.15 x (45)m													36.9972
Water storage loss:													300.0000 (47)
Store volume													2.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.3500 (55)
Enter (49) or (54) in (55)													1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (56)	
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (64)	
12Total per year (kWh/year)													3144.4406 (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	134.1003	119.2114	127.9079	115.1366	113.5024	104.3059	104.2699	107.1725	107.0086	116.9221	121.4380	132.9581 (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	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	223.6235	247.5832	223.6235	231.0776	223.6235	231.0776	223.6235	223.6235	231.0776	223.6235	231.0776	223.6235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	443.1471	447.7455	436.1575	411.4880	380.3472	351.0792	331.5263	326.9278	338.5159	363.1854	394.3262	423.5942 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397 (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)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)	180.2423	177.3980	171.9192	159.9119	152.5570	144.8692	140.1477	144.0490	148.6230	157.1534	168.6638	178.7071 (72)
Total internal gains	916.6321	942.3459	901.3195	872.0967	826.1468	796.6452	764.9167	764.2196	787.8357	813.5814	863.6869	895.5441 (73)

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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	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	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)															
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	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	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	0.0000	0.0000	(235d)
Annual totals kWh/year															
Space heating fuel - main system 1														4154.5040	(211)
Space heating fuel - main system 2														0.0000	(213)
Space heating fuel - secondary														0.0000	(215)
Efficiency of water heater														167.8557	
Water heating fuel used														1873.2999	(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)														453.8493	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation														0.0000	(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														6481.6532	(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	4154.5040	0.1559	647.5112	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1873.2999	0.1409	263.9094	(264)
Space and water heating			911.4206	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	453.8493	0.1443	65.5045	(268)
Total CO2, kg/year			976.9251	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4700	(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	4154.5040	1.5770	6551.5123	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1873.2999	1.5209	2849.1395	(278)
Space and water heating			9400.6518	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	453.8493	1.5338	696.1292	(282)
Total Primary energy kWh/year			10096.7810	(286)
Dwelling Primary energy Rate (DPER)			35.8600	(287)

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

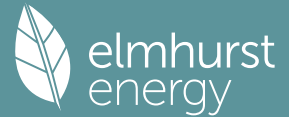
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538	(1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 704.4110	(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)
Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0568	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

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WWHRS	305.2765	269.9851	286.6528	251.4051	243.3279	218.8316	215.5610	224.2906	226.9601	253.6128	270.3567	301.8414 (62)
PV diverter	-34.8948	-30.8613	-32.3162	-26.7591	-24.9385	-21.3400	-20.0029	-21.2711	-22.0792	-26.0290	-29.4877	-34.2486 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	270.3817	239.1238	254.3367	224.6460	218.3895	197.4915	195.5582	203.0196	204.8808	227.5838	240.8690	267.5927 (64)
								Total per year (kWh/year) = Sum(64)m =				2743.8732 (64)
12Total per year (kWh/year)												2744 (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	128.9134	114.5265	122.7210	110.1170	108.3155	99.2863	99.0830	101.9856	101.9890	111.7352	116.4184	127.7712 (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
	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	223.6235	247.5832	223.6235	231.0776	223.6235	231.0776	223.6235	223.6235	231.0776	223.6235	231.0776	223.6235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	443.1471	447.7455	436.1575	411.4880	380.3472	351.0792	331.5263	326.9278	338.5159	363.1854	394.3262	423.5942 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)	173.2707	170.4264	164.9476	152.9403	145.5854	137.8976	133.1761	137.0774	141.6514	150.1818	161.6922	171.7355 (72)
Total internal gains	912.6605	938.3743	897.3479	868.1251	822.1752	789.6736	757.9451	757.2480	780.8641	809.6098	859.7153	891.5725 (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	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)						
East	23.5600	19.6403	0.6300	0.7000	0.7700	141.4147 (76)						
South	15.3800	46.7521	0.6300	0.7000	0.7700	219.7500 (78)						
West	10.1000	19.6403	0.6300	0.7000	0.7700	60.6234 (80)						
East	4.7900	26.6072	0.6300	0.7000	1.0000	50.5844 (82)						
West	4.3700	26.6072	0.6300	0.7000	1.0000	46.1490 (82)						
Solar gains	523.7860	960.7508	1464.3389	2012.7351	2397.3042	2432.6207	2324.1455	2035.9323	1657.5966	1105.3420	640.6409	439.2440 (83)
Total gains	1436.4465	1899.1251	2361.6867	2880.8602	3219.4794	3222.2943	3082.0907	2793.1803	2438.4608	1914.9518	1500.3562	1330.8165 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	33.3943	33.4573	33.5194	33.8140	33.8697	34.1314	34.1314	34.1803	34.0301	33.8697	33.7572	33.6404
alpha	3.2263	3.2305	3.2346	3.2543	3.2580	3.2754	3.2754	3.2787	3.2687	3.2580	3.2505	3.2427
util living area	0.9888	0.9729	0.9378	0.8539	0.7200	0.5557	0.4208	0.4763	0.7100	0.9159	0.9786	0.9911 (86)
MIT	18.6802	19.0592	19.5915	20.2151	20.6604	20.8947	20.9680	20.9521	20.7609	20.1080	19.2657	18.6174 (87)
Th 2	19.9901	19.9918	19.9935	20.0014	20.0029	20.0097	20.0097	20.0110	20.0071	20.0029	19.9999	19.9968 (88)
util rest of house	0.9866	0.9678	0.9261	0.8274	0.6722	0.4846	0.3327	0.3842	0.6436	0.8945	0.9738	0.9894 (89)
MIT 2	17.2580	17.7401	18.4101	19.1766	19.6881	19.9334	19.9939	19.9854	19.8128	19.0677	18.0116	17.1818 (90)
Living area fraction									FLA = Living area / (4) =			0.2500 (91)
MIT	17.6135	18.0698	18.7054	19.4362	19.9312	20.1737	20.2374	20.2270	20.0498	19.3277	18.3251	17.5406 (92)
Temperature adjustment												0.0000 (92)
adjusted MIT	17.6135	18.0698	18.7054	19.4362	19.9312	20.1737	20.2374	20.2270	20.0498	19.3277	18.3251	17.5406 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9787	0.9541	0.9068	0.8100	0.6685	0.4970	0.3535	0.4051	0.6467	0.8762	0.9620	0.9829 (94)
Useful gains	1405.9168	1811.9426	2141.6267	2333.4030	2152.2580	1601.3688	1089.5158	1131.4107	1576.9402	1677.8010	1443.3657	1308.0178 (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	4172.5027	4119.6859	3810.9394	3261.0809	2543.4696	1709.0930	1115.3435	1171.8207	1829.8434	2696.9026	3480.1558	4150.4058 (97)
Space heating kWh	2058.3399	1550.8035	1241.9686	667.9281	291.0614	0.0000	0.0000	0.0000	0.0000	758.2116	1466.4889	2114.7367 (98a)
Space heating requirement - total per year (kWh/year)												10149.5386
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	2058.3399	1550.8035	1241.9686	667.9281	291.0614	0.0000	0.0000	0.0000	0.0000	758.2116	1466.4889	2114.7367 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10149.5386
Space heating per m2										(98c) / (4) =		36.0488 (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)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	2058.3399	1550.8035	1241.9686	667.9281	291.0614	0.0000	0.0000	0.0000	0.0000	758.2116	1466.4889	2114.7367	(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)	2230.0540	1680.1771	1345.5781	723.6490	315.3428	0.0000	0.0000	0.0000	0.0000	821.4643	1588.8287	2291.1556	(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	270.3817	239.1238	254.3367	224.6460	218.3895	197.4915	195.5582	203.0196	204.8808	227.5838	240.8690	267.5927	(64)
Efficiency of water heater (217)m	87.6522	87.4819	87.1297	86.3490	84.7048	79.8000	79.8000	79.8000	79.8000	86.5466	87.4092	87.6891	(216)
Fuel for water heating, kWh/month	308.4710	273.3408	291.9058	260.1607	257.8242	247.4831	245.0603	254.4105	256.7429	262.9611	275.5647	305.1606	(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	46.4646	37.2756	33.5625	24.5894	18.9935	15.5179	17.3265	22.5217	29.2534	38.3821	43.3525	47.7559	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-127.4323	-165.1352	-218.2581	-224.7929	-226.0183	-204.9423	-201.8629	-197.8504	-189.5175	-177.6559	-134.5441	-111.9031	(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	-123.8385	-252.0564	-486.4396	-710.8299	-921.9402	-920.3614	-909.9791	-778.9161	-582.1414	-354.1079	-163.0888	-98.6418	(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													10996.2498 (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													3239.0859 (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)													374.9955 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-8482.2542 (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													6214.0770 (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	10996.2498	0.2100	2309.2125 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3239.0859	0.2100	680.2080 (264)
Space and water heating			2989.4205 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	374.9955	0.1443	54.1234 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2179.9131	0.1365	-297.5642
PV Unit electricity exported	-6302.3411	0.1267	-798.5897
Total			-1096.1539 (269)
Total CO2, kg/year			1959.3193 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.9600 (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	10996.2498	1.1300	12425.7623 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3239.0859	1.1300	3660.1670 (278)
Space and water heating			16085.9293 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	374.9955	1.5338	575.1807 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2179.9131	1.5046	-3279.8869
PV Unit electricity exported	-6302.3411	0.4652	-2931.5926
Total			-6211.4795 (283)
Total Primary energy kWh/year			10579.7313 (286)
Target Primary Energy Rate (TPER)			37.5800 (287)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 704.4110 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0568 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3068 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2838 (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	0.3618	0.3547	0.3476	0.3122	0.3051	0.2696	0.2696	0.2625	0.2838	0.3051	0.3192	0.3334 (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	0.5655	0.5629	0.5604	0.5487	0.5465	0.5363	0.5363	0.5345	0.5403	0.5465	0.5510	0.5556 (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
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076		(27)
Doors			3.8600	1.2000	4.6320		(26a)
E RW			4.7900	1.1450	5.4847		(27a)
W RW			4.3700	1.1450	5.0038		(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500 (28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000 (29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000 (29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100 (29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000 (29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900 (30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700 (30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800 (30)
Total net area of external elements Aum(A, m ²)			601.6700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	144.0118		(33)
Block			135.2000			75.0000	10140.0000 (32c)
Stud			159.1600			9.0000	1432.4400 (32c)
Internal Floor 1			109.9400			18.0000	1978.9200 (32d)
Internal Ceiling 1			109.9400			9.0000	989.4600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 37677.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K = 133.8204 (35)

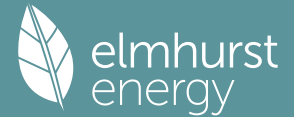
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.1700	0.0210	0.6126
E2 Other lintels (including other steel lintels)	4.4500	1.0000	4.4500
E3 Sill	12.1900	0.0240	0.2926
E3 Sill	4.4500	0.1000	0.4450
E4 Jamb	50.9000	0.0190	0.9671
E4 Jamb	3.2800	0.1000	0.3280
E5 Ground floor (normal)	64.4000	0.0450	2.8980
E6 Intermediate floor within a dwelling	40.0900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	5.0000	0.0510	0.2550
E24 Eaves (insulation at ceiling level - inverted)	11.2900	0.1500	1.6935
E11 Eaves (insulation at rafter level)	46.4200	0.0180	0.8356
E12 Gable (insulation at ceiling level)	14.7900	0.0290	0.4289
E13 Gable (insulation at rafter level)	10.8500	0.0340	0.3689
E16 Corner (normal)	21.4000	0.0370	0.7918
E17 Corner (inverted - internal area greater than external area)	7.0500	-0.0790	-0.5569
R1 Head of roof window	6.5400	0.0580	0.3793
R2 Sill of roof window	6.5400	0.0490	0.3205
R3 Jamb of roof window	19.6200	0.0580	1.1380
R6 Flat ceiling	40.4000	0.1200	4.8480
R7 Flat ceiling (inverted)	9.0800	0.1200	1.0896
R8 Roof to wall (rafter)	12.4600	0.1200	1.4952

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

23.0805 (36)

Full SAP Calculation Printout



Point Thermal bridges																
Total fabric heat loss															(33) + (36) + (36a) =	0.0000 (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	131.4432	130.8523	130.2732	127.5531	127.0441	124.6749	124.6749	124.2362	125.5875	127.0441	128.0737	129.1500	(38)			
Average = Sum(39)m / 12 =	298.5354	297.9446	297.3655	294.6453	294.1364	291.7672	291.7672	291.3285	292.6798	294.1364	295.1660	296.2423	(39)			
	46.4585	44.7691	43.0797	41.3903	39.7009	38.0115	38.0115	39.7009	41.3903	43.0797	44.7691	46.4585	(40)			
HLP	1.0603	1.0582	1.0562	1.0465	1.0447	1.0363	1.0363	1.0347	1.0395	1.0447	1.0484	1.0522	(40)			
HLP (average)												1.0465				
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31				

4. Water heating energy requirements (kWh/year)

Assumed occupancy																3.1079 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	32.9476	32.4583	31.7692	30.4987	29.5474	28.4925	27.9227	28.6069	29.3519	30.4807	31.7774	32.8362	(42b)			
Hot water usage for other uses	46.4585	44.7691	43.0797	41.3903	39.7009	38.0115	38.0115	39.7009	41.3903	43.0797	44.7691	46.4585	(42c)			
Average daily hot water use (litres/day)																72.7826 (43)
Daily hot water use	79.4060	77.2273	74.8489	71.8890	69.2482	66.5039	65.9341	68.3078	70.7422	73.5604	76.5464	79.2947	(44)			
Energy conte	125.7598	109.9707	115.0399	98.4124	93.2214	81.7744	79.7416	84.5793	87.2322	99.8207	109.0544	124.1563	(45)			
Energy content (annual)																1208.7631
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:																
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage																
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	106.8958	93.4751	97.7839	83.6505	79.2382	69.5082	67.7804	71.8924	74.1474	84.8476	92.6963	105.5328	(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	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	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	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	0.0000	0.0000	0.0000	(63d)
Output from w/h	106.8958	93.4751	97.7839	83.6505	79.2382	69.5082	67.7804	71.8924	74.1474	84.8476	92.6963	105.5328	(64)			
Total per year (kWh/year)																1027.4486 (64)
Electric shower(s)	61.1275	54.4651	59.4738	56.7552	57.8202	55.1548	56.9933	57.8202	56.7552	59.4738	58.3555	61.1275	(64a)			
Heat gains from water heating, kWh/month	42.0058	36.9851	39.3144	35.1014	34.2646	31.1658	31.1934	32.4281	32.7256	36.0804	37.7629	41.6651	(65)			
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =																695.3222 (64a)

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

Metabolic gains (Table 5), Watts																
(66)m	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	223.6235	247.5832	223.6235	231.0776	223.6235	231.0776	223.6235	223.6235	231.0776	223.6235	231.0776	223.6235	231.0776	223.6235	223.6235	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	443.1471	447.7455	436.1575	411.4880	380.3472	351.0792	331.5263	326.9278	338.5159	363.1854	394.3262	423.5942	423.5942	423.5942	423.5942	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	(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	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	(71)
Water heating gains (Table 5)	56.4595	55.0373	52.8420	48.7520	46.0546	43.2858	41.9266	43.5862	45.4523	48.4951	52.4485	56.0015	56.0015	56.0015	56.0015	(72)
Total internal gains	792.8492	819.9852	782.2422	760.9368	719.6444	695.0617	666.6957	663.7568	684.6650	704.9232	747.4716	772.8384	772.8384	772.8384	772.8384	(73)

6. Solar gains

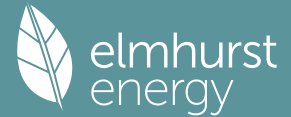
[Jan]		Area	Solar flux		g	FF	Access	Gains
		m2	Table 6a	W/m2	Specific data	Specific data	factor	W
					or Table 6b	or Table 6c	Table 6d	
North		1.6200	10.6334		0.6300	0.7000	0.7700	5.2645 (74)
East		23.5600	19.6403		0.6300	0.7000	0.7700	141.4147 (76)
South		15.3800	46.7521		0.6300	0.7000	0.7700	219.7500 (78)
West		10.1000	19.6403		0.6300	0.7000	0.7700	60.6234 (80)
East		4.7900	26.6072		0.6300	0.7000	1.0000	50.5844 (82)
West		4.3700	26.6072		0.6300	0.7000	1.0000	46.1490 (82)

Solar gains	523.7860	960.7508	1464.3389	2012.7351	2397.3042	2432.6207	2324.1455	2035.9323	1657.5966	1105.3420	640.6409	439.2440	(83)
Total gains	1316.6352	1780.7360	2246.5811	2773.6719	3116.9486	3127.6824	2990.8412	2699.6891	2342.2616	1810.2652	1388.1125	1212.0824	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)																21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)																
tau	35.0574	35.1269	35.1953	35.5202	35.5817	35.8706	35.8706	35.9246	35.7588	35.5817	35.4576	35.3287				

Full SAP Calculation Printout



alpha	3.3372	3.3418	3.3464	3.3680	3.3721	3.3914	3.3914	3.3950	3.3839	3.3721	3.3638	3.3552
util living area	0.9913	0.9768	0.9426	0.8569	0.7186	0.5503	0.4150	0.4721	0.7117	0.9226	0.9826	0.9934 (86)
MIT	18.7263	19.1099	19.6427	20.2627	20.6924	20.9091	20.9735	20.9592	20.7809	20.1380	19.3019	18.6636 (87)
Th 2	20.0334	20.0351	20.0368	20.0448	20.0462	20.0532	20.0532	20.0545	20.0505	20.0462	20.0432	20.0401 (88)
util rest of house	0.9896	0.9724	0.9318	0.8314	0.6722	0.4821	0.3312	0.3840	0.6474	0.9029	0.9786	0.9921 (89)
MIT 2	17.9366	18.3179	18.8418	19.4382	19.8230	20.0014	20.0427	20.0372	19.9105	19.3362	18.5168	17.8788 (90)
Living area fraction	18.1340	18.5159	19.0420	19.6443	20.0403	20.2283	20.2754	20.2676	20.1280	19.5366	18.7131	18.0749 (92)
MIT	18.1340	18.5159	19.0420	19.6443	20.0403	20.2283	20.2754	20.2676	20.1280	19.5366	18.7131	18.0749 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1340	18.5159	19.0420	19.6443	20.0403	20.2283	20.2754	20.2676	20.1280	19.5366	18.7131	18.0749 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9849	0.9632	0.9180	0.8192	0.6719	0.4952	0.3514	0.4046	0.6531	0.8899	0.9710	0.9882 (94)
Useful gains	1296.7296	1715.1248	2062.4255	2272.0590	2094.2039	1548.9217	1050.8977	1092.2112	1529.6667	1611.0323	1347.8544	1197.8105 (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	4129.9388	4056.7745	3729.5567	3165.7553	2453.1825	1642.1555	1072.3581	1126.7505	1764.2826	2628.5919	3427.7888	4110.3436 (97)
Space heating kWh	2107.9076	1573.5886	1240.3456	643.4614	267.0801	0.0000	0.0000	0.0000	0.0000	757.0643	1497.5527	2166.9246 (98a)
Space heating requirement - total per year (kWh/year)												10253.9249
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	2107.9076	1573.5886	1240.3456	643.4614	267.0801	0.0000	0.0000	0.0000	0.0000	757.0643	1497.5527	2166.9246 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10253.9249
Space heating per m2										(98c) / (4) =		36.4196 (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	2742.6118	2159.0774	2214.0965	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8503	0.9018	0.8702	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2331.9755	1947.1555	1926.6092	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3433.8632	3284.3223	2966.4874	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	793.3592	994.8521	773.6694	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	198.3398	248.7130	193.4174	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												640.4702 (107)
Energy for space heating												36.4196 (99)
Energy for space cooling												2.2748 (108)
Total												38.6944 (109)
Fabric Energy Efficiency (DFEE)												38.7 (109)

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

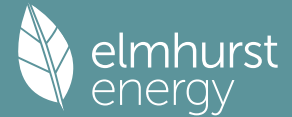
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	704.4110 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0568 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3068 (18)
Number of sides sheltered	1 (19)

Full SAP Calculation Printout



Shelter factor (20) = $1 - [0.075 \times (19)] = 0.9250$ (20)
Infiltration rate adjusted to include shelter factor (21) = $(18) \times (20) = 0.2838$ (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	0.3618	0.3547	0.3476	0.3122	0.3051	0.2696	0.2696	0.2625	0.2838	0.3051	0.3192	0.3334	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(22b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5655	0.5629	0.5604	0.5487	0.5465	0.5363	0.5363	0.5345	0.5403	0.5465	0.5510	0.5556	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			3.8600	1.0000	3.8600			(26a)
TER Opening Type (Uw = 1.20)			50.6600	1.1450	58.0076			(27)
E RW			4.7900	1.5918	7.6245			(27a)
W RW			4.3700	1.5918	6.9560			(27a)
Ground Floor			171.6100	0.1300	22.3093			(28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1800	16.7112			(29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440			(29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1800	8.9262			(29a)
Brick Plinth Walls	43.7900		43.7900	0.1800	7.8822			(29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1100	9.5711			(30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1100	1.2243			(30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842			(30)
Total net area of external elements Aum (A, m2)			601.6700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 152.5007			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.8204 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	29.1700	0.0500	1.4585	
E2 Other lintels (including other steel lintels)	4.4500	0.0500	0.2225	
E3 Sill	12.1900	0.0500	0.6095	
E3 Sill	4.4500	0.0500	0.2225	
E4 Jamb	50.9000	0.0500	2.5450	
E4 Jamb	3.2800	0.0500	0.1640	
E5 Ground floor (normal)	64.4000	0.1600	10.3040	
E6 Intermediate floor within a dwelling	40.0900	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	5.0000	0.0600	0.3000	
E24 Eaves (insulation at ceiling level - inverted)	11.2900	0.2400	2.7096	
E11 Eaves (insulation at rafter level)	46.4200	0.0400	1.8568	
E12 Gable (insulation at ceiling level)	14.7900	0.0600	0.8874	
E13 Gable (insulation at rafter level)	10.8500	0.0800	0.8680	
E16 Corner (normal)	21.4000	0.0900	1.9260	
E17 Corner (inverted - internal area greater than external area)	7.0500	-0.0900	-0.6345	
R1 Head of roof window	6.5400	0.0800	0.5232	
R2 Sill of roof window	6.5400	0.0600	0.3924	
R3 Jamb of roof window	19.6200	0.0800	1.5696	
R6 Flat ceiling	40.4000	0.0600	2.4240	
R7 Flat ceiling (inverted)	9.0800	0.0400	0.3632	
R8 Roof to wall (rafter)	12.4600	0.0600	0.7476	

Thermal bridges (Sum(L x Psi)) calculated using Appendix K) 29.4593 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 181.9600 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	131.4432	130.8523	130.2732	127.5531	127.0441	124.6749	124.6749	124.2362	125.5875	127.0441	128.0737	129.1500	(38)
Heat transfer coeff	313.4031	312.8123	312.2332	309.5130	309.0041	306.6349	306.6349	306.1962	307.5475	309.0041	310.0336	311.1100	(39)
Average = Sum(39)m / 12 =												309.5106	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1131	1.1110	1.1090	1.0993	1.0975	1.0891	1.0891	1.0875	1.0923	1.0975	1.1012	1.1050	(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 3.1079 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 32.9476 32.4583 31.7692 30.4987 29.5474 28.4925 27.9227 28.6069 29.3519 30.4807 31.7774 32.8362 (42b)

Hot water usage for other uses 46.4585 44.7691 43.0797 41.3903 39.7009 38.0115 38.0115 39.7009 41.3903 43.0797 44.7691 46.4585 (42c)

Average daily hot water use (litres/day) 72.7826 (43)

Daily hot water use

79.4060 77.2273 74.8489 71.8890 69.2482 66.5039 65.9341 68.3078 70.7422 73.5604 76.5464 79.2947 (44)

Energy content (annual) 125.7598 109.9707 115.0399 98.4124 93.2214 81.7744 79.7416 84.5793 87.2322 99.8207 109.0544 124.1563 (45)

Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1208.7631

Water storage loss: 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 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 0.0000 (56)

If cylinder contains dedicated solar storage 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 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 0.0000 (61)

Total heat required for water heating calculated for each month

106.8958 93.4751 97.7839 83.6505 79.2382 69.5082 67.7804 71.8924 74.1474 84.8476 92.6963 105.5328 (62)

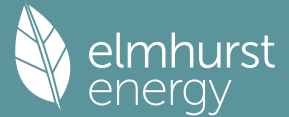
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

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 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 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 0.0000 (63d)

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Output from w/h	106.8958	93.4751	97.7839	83.6505	79.2382	69.5082	67.7804	71.8924	74.1474	84.8476	92.6963	105.5328 (64)
	Total per year (kWh/year) = Sum(64)m = 1027.4486 (64)											
12Total per year (kWh/year)	1027 (64)											
Electric shower(s)	61.1275	54.4651	59.4738	56.7552	57.8202	55.1548	56.9933	57.8202	56.7552	59.4738	58.3555	61.1275 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 695.3222 (64a)											
Heat gains from water heating, kWh/month	42.0058	36.9851	39.3144	35.1014	34.2646	31.1658	31.1934	32.4281	32.7256	36.0804	37.7629	41.6651 (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 (66)
	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972	155.3972 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	223.6235	247.5832	223.6235	231.0776	223.6235	231.0776	223.6235	223.6235	231.0776	223.6235	231.0776	223.6235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	443.1471	447.7455	436.1575	411.4880	380.3472	351.0792	331.5263	326.9278	338.5159	363.1854	394.3262	423.5942 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397	38.5397 (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)												
	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)												
	56.4595	55.0373	52.8420	48.7520	46.0546	43.2858	41.9266	43.5862	45.4523	48.4951	52.4485	56.0015 (72)
Total internal gains												
	792.8492	819.9852	782.2422	760.9368	719.6444	695.0617	666.6957	663.7568	684.6650	704.9232	747.4716	772.8384 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)
East		23.5600	19.6403	0.6300	0.7000	0.7700	141.4147 (76)
South		15.3800	46.7521	0.6300	0.7000	0.7700	219.7500 (78)
West		10.1000	19.6403	0.6300	0.7000	0.7700	60.6234 (80)
East		4.7900	26.6072	0.6300	0.7000	1.0000	50.5844 (82)
West		4.3700	26.6072	0.6300	0.7000	1.0000	46.1490 (82)

Solar gains	523.7860	960.7508	1464.3389	2012.7351	2397.3042	2432.6207	2324.1455
Total gains	1316.6352	1780.7360	2246.5811	2773.6719	3116.9486	3127.6824	2990.8412
	1657.5966	1105.3420	640.6409	439.2440 (83)	2342.2616	1810.2652	1388.1125
				1212.0824 (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	33.3943	33.4573	33.5194	33.8140	33.8697	34.1314	34.1314	34.1803	34.0301	33.8697	33.7572	33.6404
alpha	3.2263	3.2305	3.2346	3.2543	3.2580	3.2754	3.2754	3.2787	3.2687	3.2580	3.2505	3.2427
util living area												
	0.9913	0.9772	0.9449	0.8646	0.7332	0.5686	0.4322	0.4902	0.7266	0.9263	0.9828	0.9933 (86)
MIT	18.6102	18.9938	19.5356	20.1774	20.6404	20.8873	20.9654	20.9479	20.7429	20.0609	19.2022	18.5472 (87)
Th 2	19.9901	19.9918	19.9935	20.0014	20.0029	20.0097	20.0097	20.0110	20.0071	20.0029	19.9999	19.9968 (88)
util rest of house												
	0.9895	0.9729	0.9344	0.8394	0.6861	0.4969	0.3422	0.3963	0.6610	0.9069	0.9788	0.9919 (89)
MIT 2	17.7914	18.1728	18.7060	19.3248	19.7418	19.9457	19.9963	19.9891	19.8429	19.2306	18.3879	17.7333 (90)
Living area fraction FLA = Living area / (4) = 0.2500 (91)												
MIT	17.9961	18.3780	18.9134	19.5379	19.9664	20.1811	20.2385	20.2288	20.0678	19.4381	18.5915	17.9367 (92)
Temperature adjustment adjusted MIT 17.9961 18.3780 18.9134 19.5379 19.9664 20.1811 20.2385 20.2288 20.0678 19.4381 18.5915 17.9367 (93)												

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9846	0.9634	0.9200	0.8258	0.6842	0.5100	0.3636	0.4178	0.6655	0.8931	0.9710	0.9879 (94)
Useful gains	1296.3362	1715.4941	2066.9134	2290.6316	2132.6173	1594.9992	1087.6099	1128.0586	1558.7048	1616.8176	1347.8050	1197.4222 (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												
	4292.3987	4216.0951	3875.8666	3292.5723	2554.3665	1711.3570	1115.7003	1172.3561	1835.3939	2731.0187	3562.7434	4273.6271 (97)
Space heating kWh												
	2229.0705	1680.4038	1345.8612	721.3973	313.7814	0.0000	0.0000	0.0000	0.0000	828.9656	1594.7557	2288.6964 (98a)
Space heating requirement - total per year (kWh/year)												
												11002.9320
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												
	2229.0705	1680.4038	1345.8612	721.3973	313.7814	0.0000	0.0000	0.0000	0.0000	828.9656	1594.7557	2288.6964 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												11002.9320
Space heating per m ²												
										(98c) / (4) =		39.0799 (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	2882.3681	2269.0983	2327.0909	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8282	0.8841	0.8495	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	2387.2462	2006.0599	1976.8361	0.0000	0.0000	0.0000	0.0000 (102)
Total gains												
	0.0000	0.0000	0.0000	0.0000	0.0000	3433.8632	3284.3223	2966.4874	0.0000	0.0000	0.0000	0.0000 (103)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	753.5642	951.0272	736.3006	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	188.3911	237.7568	184.0752	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												610.2230 (107)
Energy for space heating												39.0799 (99)
Energy for space cooling												2.1674 (108)
Total												41.2472 (109)
Fabric Energy Efficiency (TFEE)												41.2 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 704.4110 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	7 * 10 = 70.0000 (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)	90.0000 / (5) = 0.1278 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3778 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3494 (21)

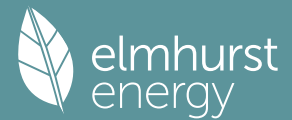
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4455	0.4368	0.4281	0.3844	0.3756	0.3320	0.3320	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843 (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
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076		(27)
Doors			3.8600	1.2000	4.6320		(26a)
E RW			4.7900	1.1450	5.4847		(27a)
W RW			4.3700	1.1450	5.0038		(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500 (28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000 (29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000 (29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100 (29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000 (29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900 (30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700 (30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800 (30)
Total net area of external elements Aum(A, m ²)			601.6700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	144.0118	(33)
Block			135.2000			75.0000	10140.0000 (32c)
Stud			159.1600			9.0000	1432.4400 (32c)
Internal Floor 1			109.9400			18.0000	1978.9200 (32d)
Internal Ceiling 1			109.9400			9.0000	989.4600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 37677.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.8204 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	29.1700	0.0210	0.6126
E2 Other lintels (including other steel lintels)	4.4500	1.0000	4.4500
E2 Other lintels (including other steel lintels)	12.1900	0.0240	0.2926
E3 Sill	4.4500	0.1000	0.4450
E4 Jamb	50.9000	0.0190	0.9671
E4 Jamb	3.2800	0.1000	0.3280
E5 Ground floor (normal)	64.4000	0.0450	2.8980

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E6 Intermediate floor within a dwelling	40.0900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	5.0000	0.0510	0.2550
E24 Eaves (insulation at ceiling level - inverted)	11.2900	0.1500	1.6935
E11 Eaves (insulation at rafter level)	46.4200	0.0180	0.8356
E12 Gable (insulation at ceiling level)	14.7900	0.0290	0.4289
E13 Gable (insulation at rafter level)	10.8500	0.0340	0.3689
E16 Corner (normal)	21.4000	0.0370	0.7918
E17 Corner (inverted - internal area greater than external area)	7.0500	-0.0790	-0.5569
R1 Head of roof window	6.5400	0.0580	0.3793
R2 Sill of roof window	6.5400	0.0490	0.3205
R3 Jamb of roof window	19.6200	0.0580	1.1380
R6 Flat ceiling	40.4000	0.1200	4.8480
R7 Flat ceiling (inverted)	9.0800	0.1200	1.0896
R8 Roof to wall (rafter)	12.4600	0.1200	1.4952
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.0805 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	167.0923 (37)

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

(38)m	Jan 139.2985	Feb 138.4026	Mar 137.5245	Apr 133.4000	May 132.6283	Jun 129.0360	Jul 129.0360	Aug 128.3707	Sep 130.4197	Oct 132.6283	Nov 134.1894	Dec 135.8215 (38)
Heat transfer coeff	306.3908	305.4949	304.6168	300.4923	299.7206	296.1283	296.1283	295.4630	297.5120	299.7206	301.2817	302.9138 (39)
Average = Sum(39)m / 12 =												300.4886

	Jan 1.0882	Feb 1.0850	Mar 1.0819	Apr 1.0673	May 1.0645	Jun 1.0518	Jul 1.0518	Aug 1.0494	Sep 1.0567	Oct 1.0645	Nov 1.0701	Dec 1.0759 (40)
HLP (average)												1.0673
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

 4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1079 (42)
Hot water usage for mixer showers	76.3299	75.1828	73.5113	70.3131	67.9529	65.3209	63.8248	65.4837	67.3022	70.1282	73.3951	76.0375 (42a)	
Hot water usage for baths	32.9476	32.4583	31.7692	30.4987	29.5474	28.4925	27.9227	28.6069	29.3519	30.4807	31.7774	32.8362 (42b)	
Hot water usage for other uses	46.4585	44.7691	43.0797	41.3903	39.7009	38.0115	38.0115	39.7009	41.3903	43.0797	44.7691	46.4585 (42c)	
Average daily hot water use (litres/day)													143.1562 (43)
Daily hot water use	Jan 155.7360	Feb 152.4102	Mar 148.3602	Apr 142.2021	May 137.2012	Jun 131.8248	Jul 129.7590	Aug 133.7915	Sep 138.0444	Oct 143.6885	Nov 149.9415	Dec 155.3321 (44)	
Energy conte	246.6477	217.0300	228.0240	194.6675	184.6991	162.0940	156.9322	165.6618	170.2225	194.9840	213.6191	243.2126 (45)	
Energy content (annual)										Total = Sum(45)m =		2377.7946	
Distribution loss (46)m = 0.15 x (45)m	36.9972	32.5545	34.2036	29.2001	27.7049	24.3141	23.5398	24.8493	25.5334	29.2476	32.0429	36.4819 (46)	
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.5000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (56)	
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (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	134.1003	119.2114	127.9079	115.1366	113.5024	104.3059	104.2699	107.1725	107.0086	116.9221	121.4380	132.9581 (65)	

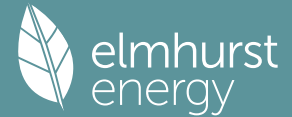
 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan 186.4767	Feb 186.4767	Mar 186.4767	Apr 186.4767	May 186.4767	Jun 186.4767	Jul 186.4767	Aug 186.4767	Sep 186.4767	Oct 186.4767	Nov 186.4767	Dec 186.4767 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.2471	57.0637	46.4073	35.1333	26.2626	22.1720	23.9576	31.1410	41.7974	53.0713	61.9421	66.0327 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	661.4135	668.2769	650.9814	614.1612	567.6823	523.9987	494.8154	487.9520	505.2476	542.0678	588.5466	632.2302 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556 (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)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)	180.2423	177.3980	171.9192	159.9119	152.5570	144.8692	140.1477	144.0490	148.6230	157.1534	168.6638	178.7071 (72)
Total internal gains	1024.8174	1021.6531	988.2224	928.1209	865.4164	809.9545	777.8352	782.0565	814.5825	871.2070	938.0671	995.8845 (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	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)
East	23.5600	19.6403	0.6300	0.7000	0.7700	141.4147 (76)

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South	15.3800	46.7521	0.6300	0.7000	0.7700	219.7500 (78)
West	10.1000	19.6403	0.6300	0.7000	0.7700	60.6234 (80)
East	4.7900	26.6072	0.6300	0.7000	1.0000	50.5844 (82)
West	4.3700	26.6072	0.6300	0.7000	1.0000	46.1490 (82)

Solar gains	523.7860	960.7508	1464.3389	2012.7351	2397.3042	2432.6207	2324.1455	2035.9323	1657.5966	1105.3420	640.6409	439.2440 (83)
Total gains	1548.6034	1982.4039	2452.5613	2940.8560	3262.7206	3242.5752	3101.9808	2817.9889	2472.1791	1976.5489	1578.7080	1435.1286 (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	34.1586	34.2587	34.3575	34.8291	34.9187	35.3423	35.3423	35.4219	35.1780	34.9187	34.7378	34.5506
alpha	3.2772	3.2839	3.2905	3.3219	3.3279	3.3562	3.3562	3.3615	3.3452	3.3279	3.3159	3.3034
util living area	0.9860	0.9692	0.9302	0.8426	0.7052	0.5402	0.4065	0.4598	0.6939	0.9067	0.9751	0.9890 (86)
Living	19.2564	19.5277	19.9233	20.3719	20.6823	20.8415	20.8887	20.8790	20.7515	20.2943	19.6836	19.2143
Non living	17.9495	18.2951	18.7928	19.3474	19.7030	19.8742	19.9129	19.9090	19.7914	19.2703	18.5051	17.9030
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1081	19.5277	19.9233	20.3719	20.6823	20.8415	20.8887	20.8790	20.7515	20.2943	19.6836	19.4641 (87)
Th 2	20.0105	20.0131	20.0156	20.0276	20.0299	20.0404	20.0404	20.0424	20.0364	20.0299	20.0253	20.0206 (88)
util rest of house	0.9834	0.9635	0.9175	0.8153	0.6577	0.4718	0.3231	0.3725	0.6282	0.8838	0.9696	0.9869 (89)
MIT 2	19.1888	18.2951	18.7928	19.3474	19.7030	19.8742	19.9129	19.9090	19.7914	19.2703	18.5051	18.2846 (90)
Living area fraction												fLA = Living area / (4) = 0.2500 (91)
MIT	19.4186	18.6032	19.0754	19.6035	19.9478	20.1160	20.1569	20.1515	20.0314	19.5263	18.7997	18.5795 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4186	18.6032	19.0754	19.6035	19.9478	20.1160	20.1569	20.1515	20.0314	19.5263	18.7997	18.5795 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9815	0.9529	0.9027	0.8018	0.6534	0.4774	0.3335	0.3828	0.6278	0.8694	0.9603	0.9827 (94)
Useful gains	1519.9109	1888.9685	2213.9070	2357.8898	2131.7646	1547.9714	1034.5825	1078.7139	1552.0222	1718.3956	1515.9894	1410.3440 (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	4632.2038	4186.2598	3830.6748	3216.3320	2472.0317	1633.4542	1053.2882	1108.4283	1764.6625	2675.3871	3524.9016	4355.7361 (97)
Space heating kWh	2315.5459	1543.7798	1202.8753	618.0784	253.1587	0.0000	0.0000	0.0000	0.0000	712.0017	1446.4168	2191.3717 (98a)
Space heating requirement - total per year (kWh/year)												10283.2282
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	2315.5459	1543.7798	1202.8753	618.0784	253.1587	0.0000	0.0000	0.0000	0.0000	712.0017	1446.4168	2191.3717 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10283.2282
Space heating per m2												(98c) / (4) = 36.5236 (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 %)												254.4415 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2315.5459	1543.7798	1202.8753	618.0784	253.1587	0.0000	0.0000	0.0000	0.0000	712.0017	1446.4168	2191.3717 (98)
Space heating efficiency (main heating system 1)	254.4415	254.4415	254.4415	254.4415	254.4415	0.0000	0.0000	0.0000	0.0000	254.4415	254.4415	254.4415 (210)
Space heating fuel (main heating system)	910.0503	606.7326	472.7512	242.9157	99.4958	0.0000	0.0000	0.0000	0.0000	279.8292	568.4673	861.2477 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (64)
Efficiency of water heater	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557 (216)
Fuel for water heating, kWh/month	185.7310	164.3324	174.6360	153.5125	148.8252	134.1069	132.2830	137.4837	138.9494	154.9524	164.8029	183.6845 (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	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	56.2351	45.1139	40.6200	29.7600	22.9875	18.7810	20.9699	27.2575	35.4048	46.4530	52.4686	57.7980 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)

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Annual totals kWh/year		
Space heating fuel - main system 1	4041.4899	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	167.8557	
Water heating fuel used	1873.2999	(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)	453.8493	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	6368.6390	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4041.4899	16.4900	666.4417	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1873.2999	16.4900	308.9071	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	453.8493	16.4900	74.8398	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1050.1886	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1578	(257)
SAP value		81.2326	
SAP rating (Section 12)		81	(258)
SAP band		B	

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	4041.4899	0.1559	629.8955	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1873.2999	0.1409	263.9094	(264)
Space and water heating			893.8049	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	453.8493	0.1443	65.5045	(268)
Total CO2, kg/year			959.3094	(272)
CO2 emissions per m2			3.4100	(273)
EI value			96.0635	
EI rating			96	(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)	
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b)	- (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	704.4110	(5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	7 * 10 = 70.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 90.0000 / (5) = 0.1278 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.3778 (18)
 Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3494 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.7000	4.7000	4.1000	4.1000	3.7000	3.7000	3.7000	3.9000	4.1000	4.2000	4.4000 (22)
Wind factor	1.2250	1.1750	1.1750	1.0250	1.0250	0.9250	0.9250	0.9250	0.9750	1.0250	1.0500	1.1000 (22a)
Adj infilt rate												
Effective ac	0.4281	0.4106	0.4106	0.3582	0.3582	0.3232	0.3232	0.3232	0.3407	0.3582	0.3669	0.3844 (22b)
	0.5916	0.5843	0.5843	0.5641	0.5641	0.5522	0.5522	0.5522	0.5580	0.5641	0.5673	0.5739 (25)

3. Heat losses and heat loss parameter

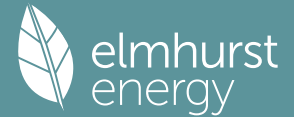
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076		(27)
Doors			3.8600	1.2000	4.6320		(26a)
E RW			4.7900	1.1450	5.4847		(27a)
W RW			4.3700	1.1450	5.0038		(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500 (28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000 (29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000 (29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100 (29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000 (29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900 (30a)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700 (30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800 (30)
Total net area of external elements Aum(A, m2)			601.6700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 144.0118		(33)
Block			135.2000			75.0000	10140.0000 (32c)
Stud			159.1600			9.0000	1432.4400 (32c)
Internal Floor 1			109.9400			18.0000	1978.9200 (32d)
Internal Ceiling 1			109.9400			9.0000	989.4600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 37677.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							133.8204 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				29.1700	0.0210		0.6126
E2 Other lintels (including other steel lintels)				4.4500	1.0000		4.4500
E3 Sill				12.1900	0.0240		0.2926
E3 Sill				4.4500	0.1000		0.4450
E4 Jamb				50.9000	0.0190		0.9671
E4 Jamb				3.2800	0.1000		0.3280
E5 Ground floor (normal)				64.4000	0.0450		2.8980
E6 Intermediate floor within a dwelling				40.0900	0.0000		0.0000
E10 Eaves (insulation at ceiling level)				5.0000	0.0510		0.2550
E24 Eaves (insulation at ceiling level - inverted)				11.2900	0.1500		1.6935
E11 Eaves (insulation at rafter level)				46.4200	0.0180		0.8356
E12 Gable (insulation at ceiling level)				14.7900	0.0290		0.4289
E13 Gable (insulation at rafter level)				10.8500	0.0340		0.3689
E16 Corner (normal)				21.4000	0.0370		0.7918
E17 Corner (inverted - internal area greater than external area)				7.0500	-0.0790		-0.5569
R1 Head of roof window				6.5400	0.0580		0.3793
R2 Sill of roof window				6.5400	0.0490		0.3205
R3 Jamb of roof window				19.6200	0.0580		1.1380
R6 Flat ceiling				40.4000	0.1200		4.8480
R7 Flat ceiling (inverted)				9.0800	0.1200		1.0896
R8 Roof to wall (rafter)				12.4600	0.1200		1.4952
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.0805 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 167.0923 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	137.5245	135.8215	135.8215	131.1382	131.1382	128.3707	128.3707	128.3707	129.7190	131.1382	131.8744	133.4000 (38)
Average = Sum(39)m / 12 =	304.6168	302.9138	302.9138	298.2304	298.2304	295.4630	295.4630	295.4630	296.8112	298.2304	298.9666	300.4923 (39)
												298.9829
HLP	1.0819	1.0759	1.0759	1.0592	1.0592	1.0494	1.0494	1.0494	1.0542	1.0592	1.0619	1.0673 (40)
HLP (average)												1.0619
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.1079 (42)
Hot water usage for mixer showers	76.3299	75.1828	73.5113	70.3131	67.9529	65.3209	63.8248	65.4837	67.3022	70.1282	73.3951	76.0375 (42a)
Hot water usage for baths	32.9476	32.4583	31.7692	30.4987	29.5474	28.4925	27.9227	28.6069	29.3519	30.4807	31.7774	32.8362 (42b)
Hot water usage for other uses	46.4585	44.7691	43.0797	41.3903	39.7009	38.0115	38.0115	39.7009	41.3903	43.0797	44.7691	46.4585 (42c)
Average daily hot water use (litres/day)												143.1562 (43)
Daily hot water use	155.7360	152.4102	148.3602	142.2021	137.2012	131.8248	129.7590	133.7915	138.0444	143.6885	149.9415	155.3321 (44)
Energy conte	246.6477	217.0300	228.0240	194.6675	184.6991	162.0940	156.9322	165.6618	170.2225	194.9840	213.6191	243.2126 (45)
Energy content (annual)										Total = Sum(45)m =		2377.7946
Distribution loss (46)m = 0.15 x (45)m	36.9972	32.5545	34.2036	29.2001	27.7049	24.3141	23.5398	24.8493	25.5334	29.2476	32.0429	36.4819 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5000 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (56)
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (64)
	Total per year (kWh/year) = Sum(64)m = 3144.4406 (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	134.1003	119.2114	127.9079	115.1366	113.5024	104.3059	104.2699	107.1725	107.0086	116.9221	121.4380	132.9581 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.2471	57.0637	46.4073	35.1333	26.2626	22.1720	23.9576	31.1410	41.7974	53.0713	61.9421	66.0327 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	661.4135	668.2769	650.9814	614.1612	567.6823	523.9987	494.8154	487.9520	505.2476	542.0678	588.5466	632.2302 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556 (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)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)	180.2423	177.3980	171.9192	159.9119	152.5570	144.8692	140.1477	144.0490	148.6230	157.1534	168.6638	178.7071 (72)
Total internal gains	1024.8174	1021.6531	988.2224	928.1209	865.4164	809.9545	777.8352	782.0565	814.5825	871.2070	938.0671	995.8845 (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	1.6200	12.0392	0.6300	0.7000	0.7700	5.9605 (74)						
East	23.5600	22.4002	0.6300	0.7000	0.7700	161.2868 (76)						
South	15.3800	51.5965	0.6300	0.7000	0.7700	242.5206 (78)						
West	10.1000	22.4002	0.6300	0.7000	0.7700	69.1425 (80)						
East	4.7900	30.5314	0.6300	0.7000	1.0000	58.0448 (82)						
West	4.3700	30.5314	0.6300	0.7000	1.0000	52.9552 (82)						
Solar gains	589.9104	991.5619	1482.0781	2104.5203	2435.9542	2606.3575	2462.4224	2191.1948	1785.9704	1196.8513	720.3510	489.8244 (83)
Total gains	1614.7278	2013.2150	2470.3006	3032.6411	3301.3706	3416.3120	3240.2576	2973.2514	2600.5528	2068.0583	1658.4181	1485.7089 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil, m (see Table 9a)												
tau	34.3575	34.5506	34.5506	35.0932	35.0932	35.4219	35.4219	35.4219	35.2610	35.0932	35.0068	34.8291
alpha	3.2905	3.3034	3.3034	3.3395	3.3395	3.3615	3.3615	3.3615	3.3507	3.3395	3.3338	3.3219
util living area	0.9845	0.9688	0.9286	0.8287	0.6893	0.4897	0.3485	0.3865	0.6518	0.8914	0.9714	0.9878 (86)
Living	19.2823	19.5291	19.9391	20.4140	20.7047	20.8621	20.8976	20.8933	20.7856	20.3524	19.7291	19.2517
Non living	17.9858	18.3020	18.8160	19.4016	19.7306	19.8932	19.9203	19.9181	19.8254	19.3426	18.5672	17.9556
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1213	19.5291	19.9391	20.4140	20.7047	20.8621	20.8976	20.8933	20.7856	20.3524	19.7291	19.4962 (87)
Th 2	20.0156	20.0206	20.0206	20.0343	20.0343	20.0424	20.0424	20.0424	20.0384	20.0343	20.0321	20.0276 (88)
util rest of house	0.9816	0.9631	0.9157	0.7999	0.6404	0.4206	0.2659	0.2985	0.5821	0.8655	0.9651	0.9855 (89)
MIT 2	19.2064	18.3020	18.8160	19.4016	19.7306	19.8932	19.9203	19.9181	19.8254	19.3426	18.5672	18.3289 (90)
Living area fraction	FLA = Living area / (4) = 0.2500 (91)											
MIT	19.4351	18.6087	19.0967	19.6547	19.9741	20.1354	20.1646	20.1619	20.0655	19.5951	18.8576	18.6207 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4351	18.6087	19.0967	19.6547	19.9741	20.1354	20.1646	20.1619	20.0655	19.5951	18.8576	18.6207 (93)

8. Space heating requirement

Utilisation	0.9796	0.9525	0.9009	0.7872	0.6371	0.4275	0.2767	0.3098	0.5842	0.8514	0.9551	0.9811 (94)
Useful gains	1581.7361	1917.5549	2225.4651	2387.2496	2103.3333	1460.5726	896.4622	921.0563	1519.3551	1760.6689	1583.9569	1457.5549 (95)
Ext temp.	4.2000	4.7000	6.5000	9.0000	11.9000	15.0000	17.1000	17.0000	14.4000	10.8000	7.1000	4.2000 (96)
Heat loss rate W	4640.8679	4213.1487	3815.7202	3177.5579	2407.9428	1517.3256	905.4773	934.2192	1681.5698	2622.9520	3515.1446	4333.3200 (97)
Space heating kWh	2275.9941	1542.6390	1183.1498	569.0220	226.6295	0.0000	0.0000	0.0000	0.0000	641.5386	1390.4552	2139.5692 (98a)
Space heating requirement - total per year (kWh/year)												9968.9973
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												9968.9973

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2275.9941	1542.6390	1183.1498	569.0220	226.6295	0.0000	0.0000	0.0000	0.0000	641.5386	1390.4552	2139.5692 (98c)
Space heating requirement after solar contribution - total per year (kWh/year) 9968.9973											
Space heating per m2 (98c) / (4) = 35.4076 (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 %) 254.2727 (206)												
Efficiency of main space heating system 2 (in %) 0.0000 (207)												
Efficiency of secondary/supplementary heating system, % 65.0000 (208)												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2275.9941	1542.6390	1183.1498	569.0220	226.6295	0.0000	0.0000	0.0000	0.0000	641.5386	1390.4552	2139.5692 (98)
Space heating efficiency (main heating system 1)	254.2727	254.2727	254.2727	254.2727	254.2727	0.0000	0.0000	0.0000	0.0000	254.2727	254.2727	254.2727 (210)
Space heating fuel (main heating system)	895.0998	606.6869	465.3075	223.7842	89.1285	0.0000	0.0000	0.0000	0.0000	252.3034	546.8363	841.4468 (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	311.7601	275.8412	293.1364	257.6795	249.8115	225.1060	222.0446	230.7742	233.2345	260.0964	276.6311	308.3250 (64)
Efficiency of water heater (217)m	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547 (216)
Fuel for water heating, kWh/month	185.7322	164.3334	174.6370	153.5135	148.8261	134.1077	132.2839	137.4845	138.9503	154.9533	164.8039	183.6857 (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	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	56.2351	45.1139	40.6200	29.7600	22.9875	18.7810	20.9699	27.2575	35.4048	46.4530	52.4686	57.7980 (232)
Electricity generated by PVs (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 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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												
Space heating fuel - main system 2												
Space heating fuel - secondary												
Efficiency of water heater												
Water heating fuel used												
Space cooling fuel												
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												
Wind generation												
Hydro-electric generation (Appendix N)												
Electricity generated - Micro CHP (Appendix N)												
Appendix Q - special features												
Energy saved or generated												
Energy used												
Total delivered energy for all uses												

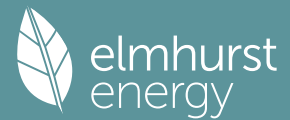
10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3920.5933	21.5100	843.3196 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1873.3113	21.5100	402.9493 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	453.8493	21.5100	97.6230 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1343.8919 (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	3920.5933	0.1561	611.9707 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1873.3113	0.1409	263.9111 (264)
Space and water heating			875.8817 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	453.8493	0.1443	65.5045 (268)
Total CO2, kg/year			941.3862 (272)

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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	3920.5933	1.5778	6186.0440 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1873.3113	1.5209	2849.1569 (278)
Space and water heating			9035.2009 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	453.8493	1.5338	696.1292 (282)
Total Primary energy kWh/year			9731.3301 (286)

SAP 10 EPC IMPROVEMENTS

ASHP

Current energy efficiency rating: B 81
 Current environmental impact rating: A 96

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 80	-46 kg (4.9%)
U Solar photovoltaic panels	+ 3.0	-£ 232	-145 kg (16.1%)

Recommended measures	Typical annual savings	Energy efficiency impact	Environmental impact
Solar water heating	£80	0.16 kg/m ²	B 82 A 96
Solar photovoltaic panels	£232	0.51 kg/m ²	B 85 A 97
Total Savings	£312	0.68 kg/m²	

Potential energy efficiency rating: B 85
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£1344	£1264	£80
Space heating	£843	£861	-£18
Water heating	£403	£305	£97
Lighting	£98	£98	£0
Generated (PV)	-£0	-£232	£232
Total cost of fuels	£1344	£1032	£312
Total cost of uses	£1344	£1032	£311
Delivered energy	22 kWh/m ²	17 kWh/m ²	5 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m ²	3 kg/m ²	3 kg/m ²	1 kg/m ²
Primary energy	35 kWh/m ²	27 kWh/m ²	8 kWh/m ²

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

1. Overall dwelling characteristics

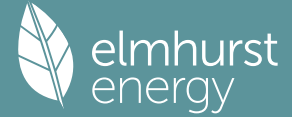
	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 704.4110 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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	7 * 10 = 70.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Air changes per hour = 90.0000 / (5) = 0.1278 (8)
 Pressure test: Yes
 Pressure Test Method: Blower Door

Full SAP Calculation Printout



Measured/design AP50													5.0000 (17)
Infiltration rate													0.3778 (18)
Number of sides sheltered													1 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3494 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate													
Effective ac	0.4455	0.4368	0.4281	0.3844	0.3756	0.3320	0.3320	0.3232	0.3494	0.3756	0.3931	0.4106	(22b)
	0.5992	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843	(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	
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076			(27)
Doors			3.8600	1.2000	4.6320			(26a)
E RW			4.7900	1.1450	5.4847			(27a)
W RW			4.3700	1.1450	5.0038			(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500	(28a)
Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000	(29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000	(29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100	(29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000	(29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900	(30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700	(30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800	(30)
Total net area of external elements Aum(A, m ²)			601.6700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 144.0118			(33)
Block			135.2000			75.0000	10140.0000	(32c)
Stud			159.1600			9.0000	1432.4400	(32c)
Internal Floor 1			109.9400			18.0000	1978.9200	(32d)
Internal Ceiling 1			109.9400			9.0000	989.4600	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 37677.1200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.8204	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.1700	0.0210	0.6126
E2 Other lintels (including other steel lintels)	4.4500	1.0000	4.4500
E3 Sill	12.1900	0.0240	0.2926
E3 Sill	4.4500	0.1000	0.4450
E4 Jamb	50.9000	0.0190	0.9671
E4 Jamb	3.2800	0.1000	0.3280
E5 Ground floor (normal)	64.4000	0.0450	2.8980
E6 Intermediate floor within a dwelling	40.0900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	5.0000	0.0510	0.2550
E24 Eaves (insulation at ceiling level - inverted)	11.2900	0.1500	1.6935
E11 Eaves (insulation at rafter level)	46.4200	0.0180	0.8356
E12 Gable (insulation at ceiling level)	14.7900	0.0290	0.4289
E13 Gable (insulation at rafter level)	10.8500	0.0340	0.3689
E16 Corner (normal)	21.4000	0.0370	0.7918
E17 Corner (inverted - internal area greater than external area)	7.0500	-0.0790	-0.5569
R1 Head of roof window	6.5400	0.0580	0.3793
R2 Sill of roof window	6.5400	0.0490	0.3205
R3 Jamb of roof window	19.6200	0.0580	1.1380
R6 Flat ceiling	40.4000	0.1200	4.8480
R7 Flat ceiling (inverted)	9.0800	0.1200	1.0896
R8 Roof to wall (rafter)	12.4600	0.1200	1.4952
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.0805 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 167.0923 (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	139.2985	138.4026	137.5245	133.4000	132.6283	129.0360	129.0360	128.3707	130.4197	132.6283	134.1894	135.8215	(38)
Average = Sum(39)m / 12 =	306.3908	305.4949	304.6168	300.4923	299.7206	296.1283	296.1283	295.4630	297.5120	299.7206	301.2817	302.9138	(39)
													300.4886

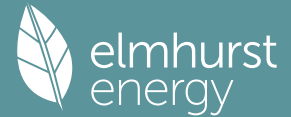
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0882	1.0850	1.0819	1.0673	1.0645	1.0518	1.0518	1.0494	1.0567	1.0645	1.0701	1.0759	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy														3.1079 (42)
Hot water usage for mixer showers														76.0375 (42a)
Hot water usage for baths														32.8362 (42b)
Hot water usage for other uses														46.4585 (42c)
Average daily hot water use (litres/day)														143.1562 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	155.7360	152.4102	148.3602	142.2021	137.2012	131.8248	129.7590	133.7915	138.0444	143.6885	149.9415	155.3321	(44)
Energy content (annual)	246.6477	217.0300	228.0240	194.6675	184.6991	162.0940	156.9322	165.6618	170.2225	194.9840	213.6191	243.2126	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2377.7946
Water storage loss:	36.9972	32.5545	34.2036	29.2001	27.7049	24.3141	23.5398	24.8493	25.5334	29.2476	32.0429	36.4819	(46)
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.5000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(56)

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If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	311.7601	275.8412	291.7407	250.9259	237.0172	212.4993	209.0177	218.6778	227.8316	258.7006	276.6311	308.3250 (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)
Aperture area of solar collector	3.0000 (H1)											
Zero-loss collector efficiency	0.8000 (H2)											
Collector linear heat loss coefficient	1.8000 (H3)											
Collector 2nd order heat loss coefficient	0.0000 (H4)											
Collector loop efficiency	0.9000 (H5)											
Incidence angle modifier	1.0000 (H6)											
Overshading factor	0.8000 (H8)											
Overall heat loss coefficient of system	6.5000 (H10)											
Heat loss coefficient of collector loop	3.9667 (H11)											
Dedicated solar storage volume	75.0000 (H12)											
Effective solar volume	75.0000 (H14)											
Reference volume	225.0000 (H15)											
Storage tank correction coefficient	1.3161 (H16)											
Heat delivered to hot water	642.4175 (H24)											
Heat delivered to space heating	0.0000 (H29)											
Solar input	642.4175											
Solar input	-0.0000	-16.1806	-59.3063	-82.4124	-108.9163	-100.6918	-100.1410	-86.8279	-59.1208	-28.8203	-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	311.7601	259.6606	232.4344	168.5135	128.1009	111.8075	108.8767	131.8498	168.7108	229.8803	276.6311	308.3250 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	134.1003	119.2114	126.7913	109.7337	103.2669	94.2205	93.8483	97.4953	102.6863	115.8055	121.4380	132.9581 (65)
Total per year (kWh/year) = Sum(64)m =	2436.5507 (64)											
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =	0.0000 (64a)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.2471	57.0637	46.4073	35.1333	26.2626	22.1720	23.9576	31.1410	41.7974	53.0713	61.9421	66.0327 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	661.4135	668.2769	650.9814	614.1612	567.6823	523.9987	494.8154	487.9520	505.2476	542.0678	588.5466	632.2302 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556 (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)	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178 (71)
Water heating gains (Table 5)	180.2423	177.3980	170.4184	152.4079	138.7996	130.8618	126.1402	131.0421	142.6198	155.6526	168.6638	178.7071 (72)
Total internal gains	1024.8174	1021.6531	986.7216	920.6169	851.6590	795.9470	763.8277	769.0496	808.5793	869.7062	938.0671	995.8845 (73)

6. Solar gains

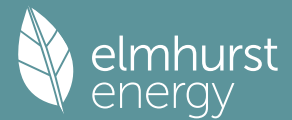
[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access Factor Table 6d	Gains W						
North	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)						
East	23.5600	19.6403	0.6300	0.7000	0.7700	141.4147 (76)						
South	15.3800	46.7521	0.6300	0.7000	0.7700	219.7500 (78)						
West	10.1000	19.6403	0.6300	0.7000	0.7700	60.6234 (80)						
East	4.7900	26.6072	0.6300	0.7000	1.0000	50.5844 (82)						
West	4.3700	26.6072	0.6300	0.7000	1.0000	46.1490 (82)						
Solar gains	523.7860	960.7508	1464.3389	2012.7351	2397.3042	2432.6207	2324.1455	2035.9323	1657.5966	1105.3420	640.6409	439.2440 (83)
Total gains	1548.6034	1982.4039	2451.0605	2933.3520	3248.9632	3228.5677	3087.9733	2804.9819	2466.1759	1975.0481	1578.7080	1435.1286 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	34.1586	34.2587	34.3575	34.8291	34.9187	35.3423	35.3423	35.4219	35.1780	34.9187	34.7378	34.5506
util living area	3.2772	3.2839	3.2905	3.3219	3.3279	3.3562	3.3562	3.3615	3.3452	3.3279	3.3159	3.3034
util living area	0.9860	0.9692	0.9303	0.8434	0.7069	0.5420	0.4082	0.4617	0.6949	0.9068	0.9751	0.9890 (86)
Living	19.2564	19.5277	19.9228	20.3701	20.6805	20.8408	20.8885	20.8787	20.7507	20.2939	19.6836	19.2143
Non living	17.9495	18.2951	18.7921	19.3453	19.7012	19.8737	19.9128	19.9088	19.7907	19.2697	18.5051	17.9030
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1081	19.5277	19.9228	20.3701	20.6805	20.8408	20.8885	20.8787	20.7507	20.2939	19.6836	19.4641 (87)
Th 2	20.0105	20.0131	20.0156	20.0276	20.0299	20.0404	20.0404	20.0424	20.0364	20.0299	20.0253	20.0206 (88)
util rest of house	0.9834	0.9635	0.9177	0.8162	0.6596	0.4735	0.3245	0.3741	0.6292	0.8840	0.9696	0.9869 (89)
MIT 2	19.1888	18.2951	18.7921	19.3453	19.7012	19.8737	19.9128	19.9088	19.7907	19.2697	18.5051	18.2846 (90)
Living area fraction	FLA = Living area / (4) = 0.2500 (91)											
MIT	19.4186	18.6032	19.0748	19.6015	19.9460	20.1155	20.1567	20.1513	20.0307	19.5257	18.7997	18.5795 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4186	18.6032	19.0748	19.6015	19.9460	20.1155	20.1567	20.1513	20.0307	19.5257	18.7997	18.5795 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9815	0.9529	0.9028	0.8026	0.6551	0.4791	0.3349	0.3844	0.6288	0.8696	0.9603	0.9827	(94)
Useful gains	1519.9109	1888.9685	2212.8549	2354.3341	2128.4763	1546.8745	1034.2930	1078.2634	1550.7790	1717.4689	1515.9894	1410.3440	(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	4632.2038	4186.2598	3830.4879	3215.7166	2471.4895	1633.2811	1053.2415	1108.3559	1764.4586	2675.2245	3524.9016	4355.7361	(97)
Space heating kWh	2315.5459	1543.7798	1203.5190	620.1954	255.2018	0.0000	0.0000	0.0000	0.0000	712.5702	1446.4168	2191.3717	(98a)
Space heating requirement - total per year (kWh/year)												10288.6005	
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	2315.5459	1543.7798	1203.5190	620.1954	255.2018	0.0000	0.0000	0.0000	0.0000	712.5702	1446.4168	2191.3717	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10288.6005	
Space heating per m2										(98c) / (4) =		36.5427	(99)

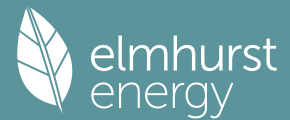
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)														254.4415	(206)
Efficiency of main space heating system 2 (in %)														0.0000	(207)
Efficiency of secondary/supplementary heating system, %														65.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	2315.5459	1543.7798	1203.5190	620.1954	255.2018	0.0000	0.0000	0.0000	0.0000	712.5702	1446.4168	2191.3717	(98)		
Space heating efficiency (main heating system 1)	254.4415	254.4415	254.4415	254.4415	254.4415	0.0000	0.0000	0.0000	0.0000	254.4415	254.4415	254.4415	(210)		
Space heating fuel (main heating system)	910.0503	606.7326	473.0042	243.7477	100.2988	0.0000	0.0000	0.0000	0.0000	280.0526	568.4673	861.2477	(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	311.7601	259.6606	232.4344	168.5135	128.1009	111.8075	108.8767	131.8498	168.7108	229.8803	276.6311	308.3250	(64)		
Efficiency of water heater (217)m	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	167.8557	(216)		
Fuel for water heating, kWh/month	185.7310	154.6927	138.4727	100.3919	76.3161	66.6093	64.8633	78.5495	100.5094	136.9511	164.8029	183.6845	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)		
Lighting	56.2351	45.1139	40.6200	29.7600	22.9875	18.7810	20.9699	27.2575	35.4048	46.4530	52.4686	57.7980	(232)		
Electricity generated by PVs (Appendix M) (negative quantity)															
(233a)m	-42.2073	-64.7794	-100.1838	-117.8983	-127.7146	-114.8102	-113.1734	-104.6842	-89.9589	-75.5064	-47.7760	-35.7247	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													4043.6013	(211)	
Space heating fuel - main system 2													0.0000	(213)	
Space heating fuel - secondary													0.0000	(215)	
Efficiency of water heater													167.8557		
Water heating fuel used													1451.5746	(219)	
Space cooling fuel													0.0000	(221)	
Electricity for pumps and fans:															
pump for solar water heating													80.0000	(230g)	
Total electricity for the above, kWh/year													80.0000	(231)	
Electricity for lighting (calculated in Appendix L)													453.8493	(232)	
Energy saving/generation technologies (Appendices M, N and Q)															
PV generation													-1034.4172	(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													4994.6080	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4043.6013	16.4900	666.7898	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1451.5746	16.4900	239.3647	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	453.8493	16.4900	74.8398	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1034.4172	16.4900	-170.5754	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-170.5754	(252)

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Total energy cost

823.6109 (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] = 0.9080 (257)
 SAP value 85.2817
 SAP rating (Section 12) 85 (258)
 SAP band B

 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	4043.6013	0.1558	630.1895 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1451.5746	0.1449	210.3449 (264)
Space and water heating			840.5344 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	453.8493	0.1443	65.5045 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1034.4172	0.1340	-138.6357
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-138.6357 (269)
Total CO2, kg/year			778.5002 (272)
CO2 emissions per m2			2.7700 (273)
EI value			96.8054
EI rating			97 (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

 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	171.6100 (1b)	x 2.5800 (2b)	= 442.7538 (1b) - (3b)
First floor	109.9400 (1c)	x 2.3800 (2c)	= 261.6572 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	281.5500		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 704.4110 (5)

 2. Ventilation rate

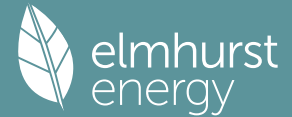
		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	1 * 20 =	20.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	7 * 10 =	70.0000 (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) =	90.0000 / (5) =	0.1278 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3778	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3494 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.7000	4.7000	4.1000	4.1000	3.7000	3.7000	3.7000	3.9000	4.1000	4.2000	4.4000 (22)
Wind factor	1.2250	1.1750	1.1750	1.0250	1.0250	0.9250	0.9250	0.9250	0.9750	1.0250	1.0500	1.1000 (22a)
Adj infilt rate												
Effective ac	0.4281	0.4106	0.4106	0.3582	0.3582	0.3232	0.3232	0.3232	0.3407	0.3582	0.3669	0.3844 (22b)
	0.5916	0.5843	0.5843	0.5641	0.5641	0.5522	0.5522	0.5522	0.5580	0.5641	0.5673	0.5739 (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
Glazing (Uw = 1.20)			50.6600	1.1450	58.0076		(27)
Doors			3.8600	1.2000	4.6320		(26a)
E RW			4.7900	1.1450	5.4847		(27a)
W RW			4.3700	1.1450	5.0038		(27a)
Ground Floor			171.6100	0.1100	18.8771	75.0000	12870.7500 (28a)

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Clad Cavity Walls	147.3600	54.5200	92.8400	0.1500	13.9260	60.0000	5570.4000 (29a)
Dormer Walls	5.8000		5.8000	0.1800	1.0440	9.0000	52.2000 (29a)
Dwarf Walls (0.72)	49.5900		49.5900	0.1200	5.9508	9.0000	446.3100 (29a)
Brick Plinth Walls	43.7900		43.7900	0.1700	7.4443	60.0000	2627.4000 (29a)
Rafter Roof	96.1700	9.1600	87.0100	0.1600	13.9216	9.0000	783.0900 (30)
Rafter Eaves (0.72)	11.1300		11.1300	0.1200	1.3356	9.0000	100.1700 (30)
Joisted Roof	76.2200		76.2200	0.1100	8.3842	9.0000	685.9800 (30)
Total net area of external elements Aum(A, m2)			601.6700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	144.0118			(33)
Block			135.2000			75.0000	10140.0000 (32c)
Stud			159.1600			9.0000	1432.4400 (32c)
Internal Floor 1			109.9400			18.0000	1978.9200 (32d)
Internal Ceiling 1			109.9400			9.0000	989.4600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 37677.1200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.8204 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.1700	0.0210	0.6126
E2 Other lintels (including other steel lintels)	4.4500	1.0000	4.4500
E3 Sill	12.1900	0.0240	0.2926
E3 Sill	4.4500	0.1000	0.4450
E4 Jamb	50.9000	0.0190	0.9671
E4 Jamb	3.2800	0.1000	0.3280
E5 Ground floor (normal)	64.4000	0.0450	2.8980
E6 Intermediate floor within a dwelling	40.0900	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	5.0000	0.0510	0.2550
E24 Eaves (insulation at ceiling level - inverted)	11.2900	0.1500	1.6935
E11 Eaves (insulation at rafter level)	46.4200	0.0180	0.8356
E12 Gable (insulation at ceiling level)	14.7900	0.0290	0.4289
E13 Gable (insulation at rafter level)	10.8500	0.0340	0.3689
E16 Corner (normal)	21.4000	0.0370	0.7918
E17 Corner (inverted - internal area greater than external area)	7.0500	-0.0790	-0.5569
R1 Head of roof window	6.5400	0.0580	0.3793
R2 Sill of roof window	6.5400	0.0490	0.3205
R3 Jamb of roof window	19.6200	0.0580	1.1380
R6 Flat ceiling	40.4000	0.1200	4.8480
R7 Flat ceiling (inverted)	9.0800	0.1200	1.0896
R8 Roof to wall (rafter)	12.4600	0.1200	1.4952

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 23.0805 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 167.0923 (37)

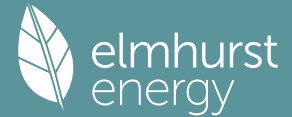
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	137.5245	135.8215	135.8215	131.1382	131.1382	128.3707	128.3707	128.3707	129.7190	131.1382	131.8744	133.4000 (38)
Average = Sum(39)m / 12 =	304.6168	302.9138	302.9138	298.2304	298.2304	295.4630	295.4630	295.4630	296.8112	298.2304	298.9666	300.4923 (39)
HLP	1.0819	1.0759	1.0759	1.0592	1.0592	1.0494	1.0494	1.0494	1.0542	1.0592	1.0619	1.0673 (40)
HLP (average)												1.0619
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1079 (42)
Hot water usage for mixer showers													76.0375 (42a)
Hot water usage for baths													32.8362 (42b)
Hot water usage for other uses													46.4585 (42c)
Average daily hot water use (litres/day)													143.1562 (43)
Daily hot water use	155.7360	152.4102	148.3602	142.2021	137.2012	131.8248	129.7590	133.7915	138.0444	143.6885	149.9415	155.3321 (44)	
Energy conte	246.6477	217.0300	228.0240	194.6675	184.6991	162.0940	156.9322	165.6618	170.2225	194.9840	213.6191	243.2126 (45)	
Energy content (annual)													Total = Sum(45)m = 2377.7946
Distribution loss (46)m = 0.15 x (45)m	36.9972	32.5545	34.2036	29.2001	27.7049	24.3141	23.5398	24.8493	25.5334	29.2476	32.0429	36.4819 (46)	
Water storage loss:													300.0000 (47)
Store volume													2.5000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.3500 (55)
Enter (49) or (54) in (55)													
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (56)	
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	311.7601	275.8412	291.7407	250.9259	237.0172	212.4993	209.0177	218.6778	227.8316	258.7006	276.6311	308.3250 (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)	
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													695.0408 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													695.0408
Solar input	-0.0000	-17.8081	-60.5882	-87.7412	-111.2909	-109.5511	-107.7650	-96.1222	-66.9038	-35.3432	-1.9271	-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	311.7601	258.0331	231.1525	163.1847	125.7263	102.9482	101.2527	122.5556	160.9278	223.3574	274.7040	308.3250 (64)	

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Electric shower(s)	Total per year (kWh/year) = Sum(64)m = 2383.9273 (64)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	134.1003	119.2114	126.7913	109.7337	103.2669	94.2205	93.8483	97.4953	102.6863	115.8055	121.4380	132.9581	(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	
	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	186.4767	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	64.2471	57.0637	46.4073	35.1333	26.2626	22.1720	23.9576	31.1410	41.7974	53.0713	61.9421	66.0327	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	661.4135	668.2769	650.9814	614.1612	567.6823	523.9987	494.8154	487.9520	505.2476	542.0678	588.5466	632.2302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	56.7556	(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)													
	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	-124.3178	(71)
Water heating gains (Table 5)													
	180.2423	177.3980	170.4184	152.4079	138.7996	130.8618	126.1402	131.0421	142.6198	155.6526	168.6638	178.7071	(72)
Total internal gains													
	1024.8174	1021.6531	986.7216	920.6169	851.6590	795.9470	763.8277	769.0496	808.5793	869.7062	938.0671	995.8845	(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	1.6200	12.0392	0.6300	0.7000	0.7700	5.9605 (74)							
East	23.5600	22.4002	0.6300	0.7000	0.7700	161.2868 (76)							
South	15.3800	51.5965	0.6300	0.7000	0.7700	242.5206 (78)							
West	10.1000	22.4002	0.6300	0.7000	0.7700	69.1425 (80)							
East	4.7900	30.5314	0.6300	0.7000	1.0000	58.0448 (82)							
West	4.3700	30.5314	0.6300	0.7000	1.0000	52.9552 (82)							
Solar gains	589.9104	991.5619	1482.0781	2104.5203	2435.9542	2606.3575	2462.4224	2191.1948	1785.9704	1196.8513	720.3510	489.8244	(83)
Total gains	1614.7278	2013.2150	2468.7998	3025.1371	3287.6133	3402.3045	3226.2501	2960.2444	2594.5496	2066.5575	1658.4181	1485.7089	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	34.3575	34.5506	34.5506	35.0932	35.0932	35.4219	35.4219	35.4219	35.2610	35.0932	35.0068	34.8291	
alpha	3.2905	3.3034	3.3034	3.3395	3.3395	3.3615	3.3615	3.3615	3.3507	3.3395	3.3338	3.3219	
util living area	0.9845	0.9688	0.9287	0.8295	0.6911	0.4914	0.3499	0.3881	0.6528	0.8916	0.9714	0.9878	(86)
Living	19.2823	19.5291	19.9386	20.4122	20.7031	20.8616	20.8975	20.8931	20.7850	20.3519	19.7291	19.2517	
Non living	17.9858	18.3020	18.8153	19.3997	19.7290	19.8929	19.9202	19.9180	19.8249	19.3421	18.5672	17.9556	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.1213	19.5291	19.9386	20.4122	20.7031	20.8616	20.8975	20.8931	20.7850	20.3519	19.7291	19.4962	(87)
Th 2	20.0156	20.0206	20.0206	20.0343	20.0343	20.0424	20.0424	20.0424	20.0384	20.0343	20.0321	20.0276	(88)
util rest of house	0.9816	0.9631	0.9159	0.8008	0.6422	0.4221	0.2671	0.2998	0.5832	0.8657	0.9651	0.9855	(89)
MIT 2	19.2064	18.3020	18.8153	19.3997	19.7290	19.8929	19.9202	19.9180	19.8249	19.3421	18.5672	18.3289	(90)
Living area fraction									FLA = Living area / (4) =			0.2500	(91)
MIT	19.4351	18.6087	19.0961	19.6528	19.9725	20.1350	20.1645	20.1618	20.0649	19.5945	18.8576	18.6207	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4351	18.6087	19.0961	19.6528	19.9725	20.1350	20.1645	20.1618	20.0649	19.5945	18.8576	18.6207	(93)

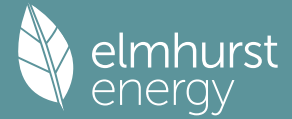
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9796	0.9525	0.9010	0.7880	0.6389	0.4291	0.2778	0.3111	0.5852	0.8516	0.9551	0.9811	(94)
Useful gains	1581.7361	1917.5549	2224.4209	2383.9122	2100.3274	1459.8432	896.3224	920.8548	1518.3887	1759.8051	1583.9569	1457.5549	(95)
Ext temp.	4.2000	4.7000	6.5000	9.0000	11.9000	15.0000	17.1000	17.0000	14.4000	10.8000	7.1000	4.2000	(96)
Heat loss rate W	4640.8679	4213.1487	3815.5354	3176.9860	2407.4515	1517.2112	905.4541	934.1860	1681.4133	2622.8013	3515.1446	4333.3200	(97)
Space heating kWh	2275.9941	1542.6390	1183.7892	571.0131	228.5003	0.0000	0.0000	0.0000	0.0000	642.0692	1390.4552	2139.5692	(98a)
Space heating requirement - total per year (kWh/year)													
													9974.0293
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	2275.9941	1542.6390	1183.7892	571.0131	228.5003	0.0000	0.0000	0.0000	0.0000	642.0692	1390.4552	2139.5692	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													
													9974.0293
Space heating per m2										(98c) / (4) =			35.4254 (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 %)	254.2727	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2275.9941	1542.6390	1183.7892	571.0131	228.5003	0.0000	0.0000	0.0000	0.0000	642.0692	1390.4552	2139.5692	(98)
Space heating efficiency (main heating system 1)	254.2727	254.2727	254.2727	254.2727	254.2727	0.0000	0.0000	0.0000	0.0000	254.2727	254.2727	254.2727	(210)
Space heating fuel (main heating system)	895.0998	606.6869	465.5590	224.5672	89.8643	0.0000	0.0000	0.0000	0.0000	252.5121	546.8363	841.4468	(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	311.7601	258.0331	231.1525	163.1847	125.7263	102.9482	101.2527	122.5556	160.9278	223.3574	274.7040	308.3250	(64)
Efficiency of water heater (217)m	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	167.8547	(216)
Fuel for water heating, kWh/month	185.7322	153.7241	137.7099	97.2179	74.9019	61.3317	60.3216	73.0129	95.8733	133.0659	163.6559	183.6857	(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)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	56.2351	45.1139	40.6200	29.7600	22.9875	18.7810	20.9699	27.2575	35.4048	46.4530	52.4686	57.7980	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-47.0482	-66.6506	-101.1412	-121.1541	-128.4089	-119.4885	-117.0203	-109.5354	-94.6821	-80.1347	-52.9492	-39.4825	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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												3922.5723	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.8547	
Water heating fuel used												1420.2330	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												453.8493	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1077.6956	(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												4798.9589	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3922.5723	21.5100	843.7453	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1420.2330	21.5100	305.4921	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	453.8493	21.5100	97.6230	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.6956	21.5100	-231.8123	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-231.8123	(252)
Total energy cost			1032.2561	(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	3922.5723	0.1561	612.2466	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1420.2330	0.1453	206.4083	(264)
Space and water heating			818.6549	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	453.8493	0.1443	65.5045	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.6956	0.1341	-144.5589	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-144.5589	(269)
Total CO2, kg/year			750.6975	(272)

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

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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3922.5723	1.5778	6189.0443 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1420.2330	1.5376	2183.7360 (278)
Space and water heating			8372.7802 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	453.8493	1.5338	696.1292 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.6956	1.4957	-1611.9415
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1611.9415 (283)
Total Primary energy kWh/year			7577.9920 (286)