

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 21 Dec 2023 07:30:23

Project Information			
Assessed By	Steven Leahy	Building Type	House, Semi-detached
OCDEA Registration	EES/004184	Assessment Date	2023-12-21

Dwelling Details			
Assessment Type	As designed	Total Floor Area	154 m ²
Site Reference	Westwynds Plot 01	Plot Reference	Plot 01
Address	Westwynds Plot 1 Loscombe Road, Redruth, TR16 6LP		

Client Details	
Name	Propcert
Company	Propcert
Address	1821 High Street, Beckenham, BR3 1EW

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	8.62 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.36 kgCO ₂ /m ²	OK	
1b Target primary energy rate and dwelling primary energy			
Target primary energy	45.03 kWh _{PE} /m ²		
Dwelling primary energy	37.93 kWh _{PE} /m ²	OK	
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	35.7 kWh/m ²		
Dwelling fabric energy efficiency	34.5 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	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground Floor (0.13)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	NE Windows (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)	93.665	0.18
Sheltered wall: Walls (2)	16.56	0.16
Party wall: Party Wall (1)	46.96	0 (!)
Ground floor: Ground Floor, Ground Floor	71.37	0.13
Upper floor: Above Garage, Above Garage	9.12	0.12
Exposed roof: Roof (1)	82.77	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]
Entrance Door, Entrance Door	3.15	North East	N/A	1 (!)
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	1.08	North East	0.7	1.2
Plot 1 SE Door, Entrance Door	1.89	South East	N/A	1 (!)
Plot 1 SE Window, Windows	0.945	South East	0.7	1.2
SW Windows, Windows	0.945	South West	0.7	1.2
SW Windows, Windows	0.945	South West	0.7	1.2
SW Windows, Windows	2.16	South West	0.7	1.2
SW Windows, Windows	2.16	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
SW Windows, Windows	2.16	South West	0.7	1.2
SW Windows, Windows	4.83	South West	0.7	1.2

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	0.02 (!)	BRE 600404
External wall	E3: Sill	Calculated by person with suitable expertise	0.029 (!)	BRE 600406
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	BRE 600409
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.067	BRE 600384
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	BRE 600413
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.048	BRE 600421
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.094	BRE 600423
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.075	BRE 600422
Party wall	P1: Ground floor	SAP table default	0.32	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.04	BRE 600417

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	170.0%
Emitter type	Both radiator and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

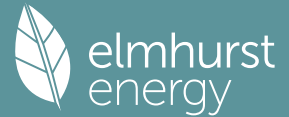
Capacity	200 litres
Declared heat loss	2.24 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	40 lm/W	FAIL
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2 kWp	
Orientation	South West	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
<p>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.</p>		<input type="text"/>
Signed:	<input type="text"/>	Assessor ID: <input type="text"/>
Name:	<input type="text"/>	Date: <input type="text"/>
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Westwynds Plot 01		Issued on Date	21/12/2023	
Assessment Reference	Plot 01	Prop Type Ref			
Property	Plot 1, Westwynds, Loscombe Road, Redruth, TR16 6LP				
SAP Rating	83 B	DER	3.36	TER	8.62
Environmental	97 A	% DER < TER			61.02
CO ₂ Emissions (t/year)	0.38	DFEE	34.46	TFEE	35.71
Compliance Check	See BREL	% DFEE < TFEE			3.50
% DPER < TPER	15.77	DPER	37.93	TPER	45.03
Assessor Details	Mr. Steven Leahy			Assessor ID	A593-0001
Client	0770, Propcert				

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	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (5)

2. Ventilation rate

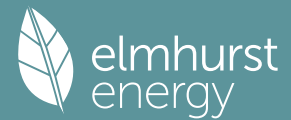
		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (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) =	50.0000 / (5) =	0.1280 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3780	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3213 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4097	0.4016	0.3936	0.3534	0.3454	0.3052	0.3052	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5596	0.5466	0.5466	0.5442	0.5516	0.5596	0.5653	0.5713 (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
Entrance Door			5.0400	1.0000	5.0400		(26a)
Windows (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000 (28a)
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000 (28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000 (29a)
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000 (29a)
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300 (30)
Total net area of external elements Aum(A, m ²)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.8767		(33)
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000 (32)
Internal Walls			256.2100			9.0000	2305.8900 (32c)
Internal Floor			73.6500			18.0000	1325.7000 (32d)
Internal Ceiling			71.3700			9.0000	642.3300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22952.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.9059 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				19.1000	0.0200	0.3820	

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E3 Sill	16.7000	0.0290	0.4843
E4 Jamb	35.7000	0.0160	0.5712
E5 Ground floor (normal)	27.1500	0.0670	1.8191
E6 Intermediate floor within a dwelling	27.1000	0.0040	0.1084
E16 Corner (normal)	10.1000	0.0480	0.4848
E18 Party wall between dwellings	10.1000	0.0940	0.9494
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0750	-0.1800
P1 Party wall - Ground floor	9.3000	0.3200	2.9760
P2 Party wall - Intermediate floor within a dwelling	9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.3000	0.4800	4.4640
E10 Eaves (insulation at ceiling level)	27.1000	0.0400	1.0840
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.1432 (36)
Point Thermal bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 82.0198 (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	75.2702	74.8502	74.4385	72.5047	72.1429	70.4587	70.4587	70.1468	71.1075	72.1429	72.8749	73.6400 (38)
Average = Sum(39)m / 12 =	157.2900	156.8700	156.4583	154.5246	154.1628	152.4786	152.4786	152.1667	153.1273	154.1628	154.8947	155.6599 (39)
												154.5228

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0204	1.0177	1.0150	1.0025	1.0001	0.9892	0.9892	0.9872	0.9934	1.0001	1.0049	1.0099 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9405 (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	84.8140	83.5544	81.7806	78.5101	76.0611	73.3456	71.8788	73.6402	75.5580	78.4637	81.8016	84.5273 (42b)	
Hot water usage for other uses	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434 (42c)	
Average daily hot water use (litres/day)													119.3118 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	129.5574	126.6707	123.2699	118.3723	114.2964	109.9538	108.4871	111.8755	115.4203	119.9530	124.9180	129.2707 (44)	
Energy content (annual)	205.1872	180.3775	189.4613	162.0458	153.8649	135.2011	131.2057	138.5252	142.3248	162.7751	177.9685	202.4066 (45)	
Distribution loss (46)m = 0.15 x (45)m	30.7781	27.0566	28.4192	24.3069	23.0797	20.2802	19.6809	20.7788	21.3487	24.4163	26.6953	30.3610 (46)	
Water storage loss:													200.0000 (47)
Store volume													2.2400 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.2096 (55)
Enter (49) or (54) in (55)													
Total storage loss	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (56)	
If cylinder contains dedicated solar storage	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666 (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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666 (64)	
Total per year (kWh/year)													2696.7437 (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	116.8328	103.8795	111.6039	100.9202	99.7681	91.9944	92.2339	94.6676	94.3630	102.7307	106.2145	115.9082 (65)	

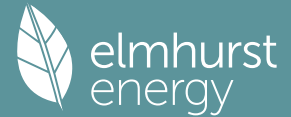
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.6263	194.4434	175.6263	181.4805	175.6263	181.4805	175.6263	175.6263	181.4805	175.6263	181.4805	175.6263 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.9905	328.3629	319.8646	301.7727	278.9350	257.4707	243.1313	239.7589	248.2572	266.3490	289.1868	310.6510 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	157.0333	154.5826	150.0052	140.1670	134.0969	127.7699	123.9703	127.2414	131.0597	138.0789	147.5202	155.7906 (72)
Total internal gains	727.7572	747.4960	715.6032	693.5273	658.7652	633.8283	609.8350	609.7337	627.9045	650.1614	688.2946	712.1751 (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
Northeast	7.5600	11.2829	0.7600	0.7000	0.7700	31.4477 (75)
Southeast	0.9500	36.7938	0.7600	0.7000	0.7700	12.8868 (77)
Southwest	13.2000	36.7938	0.7600	0.7000	0.7700	179.0580 (79)

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Solar gains	223.3925	390.9657	562.6819	743.6959	875.4497	887.7905	848.1545	747.0057	624.9190	439.5813	269.4750	189.9465 (83)
Total gains	951.1497	1138.4617	1278.2851	1437.2232	1534.2149	1521.6188	1457.9895	1356.7395	1252.8235	1089.7427	957.7696	902.1216 (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	40.5344	40.6429	40.7498	41.2598	41.3566	41.8134	41.8134	41.8991	41.6363	41.3566	41.1612	40.9589
alpha	3.7023	3.7095	3.7167	3.7507	3.7571	3.7876	3.7876	3.7933	3.7758	3.7571	3.7441	3.7306
util living area	0.9850	0.9707	0.9445	0.8791	0.7622	0.5928	0.4467	0.4947	0.7186	0.9107	0.9727	0.9876 (86)
MIT	19.5746	19.7879	20.0729	20.4339	20.7068	20.8594	20.9028	20.8957	20.7933	20.4300	19.9433	19.5439 (87)
Th 2	20.0663	20.0686	20.0708	20.0813	20.0832	20.0923	20.0923	20.0940	20.0888	20.0832	20.0793	20.0751 (88)
util rest of house	0.9821	0.9651	0.9336	0.8554	0.7174	0.5230	0.3601	0.4056	0.6540	0.8879	0.9664	0.9851 (89)
MIT 2	18.3841	18.6556	19.0152	19.4653	19.7814	19.9450	19.9801	19.9775	19.8837	19.4712	18.8632	18.3516 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5370	18.8011	19.1511	19.5897	19.9003	20.0625	20.0986	20.0955	20.0005	19.5943	19.0019	18.5047 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5370	18.8011	19.1511	19.5897	19.9003	20.0625	20.0986	20.0955	20.0005	19.5943	19.0019	18.5047 (93)

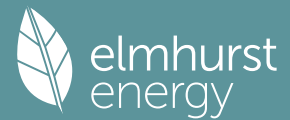
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9754	0.9550	0.9201	0.8406	0.7076	0.5206	0.3607	0.4057	0.6471	0.8730	0.9567	0.9793 (94)
Useful gains	927.7532	1087.2428	1176.1580	1208.1910	1085.5456	792.1697	525.8982	550.4950	810.7139	951.3933	916.2717	883.4184 (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	2239.3396	2180.6596	1979.3695	1651.8236	1264.1757	832.9135	533.4662	562.3253	903.5305	1386.5903	1843.5454	2226.6715 (97)
Space heating kWh	975.8203	734.7761	597.5894	319.4155	132.9007	0.0000	0.0000	0.0000	0.0000	323.7865	667.6370	999.3803 (98a)
Space heating requirement - total per year (kWh/year)												4751.3058
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	975.8203	734.7761	597.5894	319.4155	132.9007	0.0000	0.0000	0.0000	0.0000	323.7865	667.6370	999.3803 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4751.3058
Space heating per m2												(98c) / (4) = 30.8246 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	975.8203	734.7761	597.5894	319.4155	132.9007	0.0000	0.0000	0.0000	0.0000	323.7865	667.6370	999.3803 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	574.0119	432.2212	351.5231	187.8915	78.1769	0.0000	0.0000	0.0000	0.0000	190.4627	392.7277	587.8708 (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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	156.4395	138.3867	147.1890	129.9093	126.2499	114.1183	112.9210	117.2266	118.3087	131.4913	139.2756	154.8039 (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	61.1138	49.0278	44.1441	32.3418	24.9818	20.4103	22.7892	29.6223	38.4764	50.4831	57.0206	62.8123 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-36.3727	-57.1496	-90.7729	-108.9962	-119.7285	-108.2226	-106.7313	-97.9019	-82.3323	-66.9819	-41.5199	-30.7226 (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	-7.7088	-18.4194	-42.3981	-74.5464	-110.3753	-119.1192	-117.1550	-95.6756	-65.8888	-30.9225	-11.1841	-5.8732 (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												2794.8858 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1586.3198 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												

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Electricity for lighting (calculated in Appendix L)	493.2234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1646.6987 (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	3227.7303 (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	2794.8858	0.1555	434.7180 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1586.3198	0.1408	223.3414 (264)
Space and water heating			658.0593 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	493.2234	0.1443	71.1874 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-947.4323	0.1336	-126.5818
PV Unit electricity exported	-699.2664	0.1215	-84.9392
Total			-211.5210 (269)
Total CO2, kg/year			517.7257 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3600 (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	2794.8858	1.5758	4404.2771 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1586.3198	1.5206	2412.1467 (278)
Space and water heating			6816.4238 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	493.2234	1.5338	756.5225 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-947.4323	1.4937	-1415.2233
PV Unit electricity exported	-699.2664	0.4456	-311.6024
Total			-1726.8257 (283)
Total Primary energy kWh/year			5846.1206 (286)
Dwelling Primary energy Rate (DPER)			37.9300 (287)

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

 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (5)

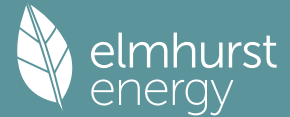
 2. Ventilation rate

	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) =	0.1024 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3524	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2995 (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												

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Effective ac	0.3819	0.3744	0.3669	0.3295	0.3220	0.2846	0.2846	0.2771	0.2995	0.3220	0.3370	0.3520 (22b)
	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5449	0.5518	0.5568	0.5619 (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			5.0400	1.0000	5.0400		(26a)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781		(28a)
Above Garage			9.1200	0.1300	1.1856		(28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588		(29a)
House to Garage Wall	16.5600		16.5600	0.1800	2.9808		(29a)
Main Roof	82.7700		82.7700	0.1100	9.1047		(30)
Total net area of external elements Aum(A, m2)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.3068	(32)
Party Wall			46.9600	0.0000	0.0000		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 148.9059 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.1000	0.0500	0.9550
E3 Sill	16.7000	0.0500	0.8350
E4 Jamb	35.7000	0.0500	1.7850
E5 Ground floor (normal)	27.1500	0.1600	4.3440
E6 Intermediate floor within a dwelling	27.1000	0.0000	0.0000
E16 Corner (normal)	10.1000	0.0900	0.9090
E18 Party wall between dwellings	10.1000	0.0600	0.6060
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P1 Party wall - Ground floor	9.3000	0.0800	0.7440
P2 Party wall - Intermediate floor within a dwelling	9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.3000	0.1200	1.1160
E10 Eaves (insulation at ceiling level)	27.1000	0.0600	1.6260

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.7040 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 82.0108 (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	73.8547	73.4897	73.1319	71.4512	71.1367	69.6729	69.6729	69.4018	70.2367	71.1367	71.7728	72.4379 (38)
Average = Sum(39)m / 12 =	155.8655	155.5005	155.1426	153.4619	153.1475	151.6837	151.6837	151.4126	152.2475	153.1475	153.7836	154.4487 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0112	1.0088	1.0065	0.9956	0.9936	0.9841	0.9841	0.9823	0.9877	0.9936	0.9977	1.0020 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9405 (42)

Hot water usage for mixer showers 0.0000 (42a)

Hot water usage for baths 84.8140 (42b)

Hot water usage for other uses 44.7434 (42c)

Average daily hot water use (litres/day) 119.3118 (43)

Daily hot water use

Energy conte 129.2707 (44)

Energy content (annual) 205.1872 (45)

Distribution loss (46)m = 0.15 x (45)m 1981.3437 (46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss 27.6637 (56)

If cylinder contains dedicated solar storage

Primary loss 27.6637 (57)

Combi loss 23.2624 (59)

Total heat required for water heating calculated for each month 0.0000 (61)

WWHRS 256.1133 (62)

PV diverter 0.0000 (63a)

Solar input -0.0000 (63b)

FGHRS 0.0000 (63c)

Output from w/h 0.0000 (63d)

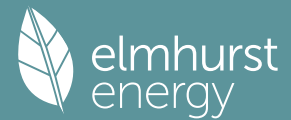
12Total per year (kWh/year) 2580.9572 (64)

Electric shower(s) 2581 (64)

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

Heat gains from water heating, kWh/month 108.9656 (65)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.9905	328.3629	319.8646	301.7727	278.9350	257.4707	243.1313	239.7589	248.2572	266.3490	289.1868	310.6510 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	146.4592	144.0085	139.4311	129.5929	123.5228	117.1958	113.3962	116.6673	120.4856	127.5048	136.9461	145.2165 (72)
Total internal gains	717.1831	736.9219	705.0291	682.9532	648.1911	623.2541	599.2608	599.1596	617.3304	639.5873	677.7205	701.6009 (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						
Northeast	7.5600	11.2829	0.6300	0.7000	0.7700	26.0685 (75)						
Southeast	0.9500	36.7938	0.6300	0.7000	0.7700	10.6824 (77)						
Southwest	13.2000	36.7938	0.6300	0.7000	0.7700	148.4297 (79)						
Solar gains	185.1806	324.0900	466.4337	616.4848	725.7017	735.9316	703.0755	619.2284	518.0250	364.3898	223.3806	157.4557 (83)
Total gains	902.3637	1061.0119	1171.4628	1299.4380	1373.8929	1359.1857	1302.3363	1218.3880	1135.3554	1003.9771	901.1011	859.0566 (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	40.9048	41.0009	41.0954	41.5455	41.6308	42.0326	42.0326	42.1078	41.8769	41.6308	41.4586	41.2801
alpha	3.7270	3.7334	3.7397	3.7697	3.7754	3.8022	3.8022	3.8072	3.7918	3.7754	3.7639	3.7520
util living area	0.9873	0.9762	0.9562	0.9044	0.8046	0.6434	0.4920	0.5404	0.7595	0.9272	0.9772	0.9894 (86)
MIT	19.1823	19.4407	19.7994	20.2731	20.6598	20.8970	20.9714	20.9592	20.7989	20.2939	19.6604	19.1428 (87)
Th 2	20.0740	20.0760	20.0779	20.0870	20.0887	20.0966	20.0966	20.0981	20.0936	20.0887	20.0853	20.0817 (88)
util rest of house	0.9848	0.9715	0.9473	0.8843	0.7633	0.5725	0.3992	0.4464	0.6976	0.9077	0.9719	0.9872 (89)
MIT 2	17.9351	18.2641	18.7181	19.3102	19.7655	20.0203	20.0823	20.0760	19.9283	19.3468	18.5521	17.8898 (90)
Living area fraction	FLA = Living area / (4) =											0.1285 (91)
MIT	18.0953	18.4153	18.8570	19.4339	19.8804	20.1329	20.1965	20.1895	20.0402	19.4685	18.6945	18.0507 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0953	18.4153	18.8570	19.4339	19.8804	20.1329	20.1965	20.1895	20.0402	19.4685	18.6945	18.0507 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9768	0.9598	0.9317	0.8669	0.7527	0.5756	0.4098	0.4564	0.6935	0.8909	0.9606	0.9802 (94)
Useful gains	881.4304	1018.3847	1091.5034	1126.4866	1034.0899	782.2933	533.7537	556.0379	787.3659	894.4340	865.5684	842.0709 (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	2150.2166	2101.6285	1917.1011	1616.5514	1252.8098	839.2570	545.5275	573.7770	904.3732	1358.1874	1783.0440	2139.2239 (97)
Space heating kWh	943.9769	727.9399	614.2447	352.8466	162.7276	0.0000	0.0000	0.0000	0.0000	345.0325	660.5824	965.0818 (98a)
Space heating requirement - total per year (kWh/year)												4772.4325
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	943.9769	727.9399	614.2447	352.8466	162.7276	0.0000	0.0000	0.0000	0.0000	345.0325	660.5824	965.0818 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4772.4325
Space heating per m2												(98c) / (4) = 30.9617 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
943.9769	727.9399	614.2447	352.8466	162.7276	0.0000	0.0000	0.0000	0.0000	0.0000	345.0325	660.5824	965.0818 (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)	1022.7269	788.6673	665.4872	382.2824	176.3029	0.0000	0.0000	0.0000	0.0000	373.8164	715.6905	1045.5925 (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	256.1133	226.3752	240.3874	211.3291	204.7909	184.4844	182.1318	189.4513	191.6081	213.7012	227.2518	253.3327 (64)
Efficiency of water heater (217)m	86.7129	86.4862	86.0696	85.2006	83.5493	79.8000	79.8000	79.8000	79.8000	85.1279	86.3085	86.7654 (217)
Fuel for water heating, kWh/month	295.3578	261.7472	279.2941	248.0371	245.1138	231.1834	228.2353	237.4076	240.1104	251.0354	263.3019	291.9744 (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	36.4917	29.2750	26.3589	19.3116	14.9169	12.1872	13.6077	17.6878	22.9746	30.1440	34.0476	37.5059 (232)

Full SAP Calculation Printout



Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-63.2230	-87.3591	-123.0438	-135.3856	-143.4234	-132.8241	-131.0489	-124.8919	-113.7591	-98.3699	-68.8205	-54.8590	(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	-41.2767	-86.1446	-170.0292	-253.7258	-333.9951	-335.1727	-331.3494	-281.3305	-207.1622	-122.7826	-54.9605	-32.7035	(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												5170.5661	(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												3072.7983	(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)												294.5088	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3527.6411	(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												5096.2321	(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	5170.5661	0.2100	1085.8189	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3072.7983	0.2100	645.2876	(264)
Space and water heating			1731.1065	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	294.5088	0.1443	42.5067	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1277.0082	0.1351	-172.4646	
PV Unit electricity exported	-2250.6328	0.1261	-283.7572	
Total			-456.2217	(269)
Total CO2, kg/year			1329.3207	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.6200	(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	5170.5661	1.1300	5842.7397	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3072.7983	1.1300	3472.2621	(278)
Space and water heating			9315.0017	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	294.5088	1.5338	451.7274	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1277.0082	1.4992	-1914.4416	
PV Unit electricity exported	-2250.6328	0.4628	-1041.6008	
Total			-2956.0425	(283)
Total Primary energy kWh/year			6940.7875	(286)
Target Primary Energy Rate (TPER)			45.0300	(287)

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

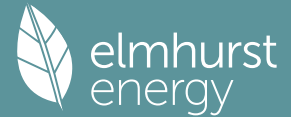
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)	
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (5)	

2. Ventilation rate

m³ per hour

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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) =	0.1024 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3524 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2995 (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	0.3819	0.3744	0.3669	0.3295	0.3220	0.2846	0.2846	0.2771	0.2995	0.3220	0.3370	0.3520	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5449	0.5518	0.5568	0.5619	(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	
Entrance Door			5.0400	1.0000	5.0400			(26a)
Windows (Uw = 1.20)			21.7100	1.1450	24.8588			(27)
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000	(28a)
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000	(28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000	(29a)
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000	(29a)
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300	(30)
Total net area of external elements Aum(A, m2)			300.2300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	68.8767		(33)
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000	(32)
Internal Walls			256.2100			9.0000	2305.8900	(32c)
Internal Floor			73.6500			18.0000	1325.7000	(32d)
Internal Ceiling			71.3700			9.0000	642.3300	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	22952.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								148.9059 (35)

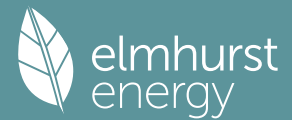
List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)		19.1000	0.0200	0.3820
E3 Sill		16.7000	0.0290	0.4843
E4 Jamb		35.7000	0.0160	0.5712
E5 Ground floor (normal)		27.1500	0.0670	1.8191
E6 Intermediate floor within a dwelling		27.1000	0.0040	0.1084
E16 Corner (normal)		10.1000	0.0480	0.4848
E18 Party wall between dwellings		10.1000	0.0940	0.9494
E17 Corner (inverted - internal area greater than external area)		2.4000	-0.0750	-0.1800
P1 Party wall - Ground floor		9.3000	0.3200	2.9760
P2 Party wall - Intermediate floor within a dwelling		9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)		9.3000	0.4800	4.4640
E10 Eaves (insulation at ceiling level)		27.1000	0.0400	1.0840
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				13.1432 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 82.0198 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	73.8547	73.4897	73.1319	71.4512	71.1367	69.6729	69.6729	69.4018	70.2367	71.1367	71.7728	72.4379	(38)
Heat transfer coeff	155.8746	155.5095	155.1517	153.4710	153.1566	151.6927	151.6927	151.4216	152.2566	153.1566	153.7927	154.4577	(39)
Average = Sum(39)m / 12 =													153.4695
HLP	1.0113	1.0089	1.0066	0.9957	0.9936	0.9841	0.9841	0.9824	0.9878	0.9936	0.9977	1.0021	(40)
HLP (average)													0.9957
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	2.9405 (42)
Hot water usage for baths	31.7400	31.2687	30.6049	29.3809	28.4644	27.4482	26.8993	27.5585	28.2762	29.3636	30.6127	31.6327	(42b)
Hot water usage for other uses	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434	(42c)
Average daily hot water use (litres/day)													70.1038 (43)
Daily hot water use	76.4834	74.3850	72.0942	69.2432	66.6997	64.0564	63.5075	65.7937	68.1385	70.8529	73.7291	76.3761	(44)
Energy conte	121.1311	105.9233	110.8061	94.7905	89.7906	78.7649	76.8068	81.4664	84.0215	96.1467	105.0406	119.5866	(45)
Energy content (annual)													Total = Sum(45)m = 1164.2750
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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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														
	102.9614	90.0348	94.1852	80.5719	76.3220	66.9501	65.2858	69.2464	71.4183	81.7247	89.2845	101.6486	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	102.9614	90.0348	94.1852	80.5719	76.3220	66.9501	65.2858	69.2464	71.4183	81.7247	89.2845	101.6486	(64)	
												Total per year (kWh/year) = Sum(64)m =	989.6337	(64)
												990	(64)	
12Total per year (kWh/year)														
Electric shower(s)	58.8788	52.4615	57.2859	54.6673	55.6931	53.1258	54.8967	55.6931	54.6673	57.2859	56.2087	58.8788	(64a)	
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	669.7429	(64a)
Heat gains from water heating, kWh/month														
	40.4600	35.6241	37.8678	33.8098	33.0038	30.0190	30.0456	31.2349	31.5214	34.7527	36.3733	40.1318	(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)
	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	175.6263	194.4434	175.6263	181.4805	175.6263	181.4805	175.6263	175.6263	181.4805	175.6263	181.4805	175.6263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.9905	328.3629	319.8646	301.7727	278.9350	257.4707	243.1313	239.7589	248.2572	266.3490	289.1868	310.6510	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	(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)													
	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	(71)
Water heating gains (Table 5)													
	54.3818	53.0120	50.8975	46.9580	44.3599	41.6930	40.3839	41.9824	43.7797	46.7106	50.5185	53.9407	(72)
Total internal gains	622.1057	642.9254	613.4955	597.3184	566.0283	547.7514	526.2486	524.4747	540.6245	555.7930	588.2929	607.3251	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m2	Table 6a	W/m2	Specific data	factor	W						
				or Table 6b	or Table 6c	Table 6d							
Northeast		7.5600	11.2829	0.7600	0.7000	0.7700	31.4477 (75)						
Southeast		0.9500	36.7938	0.7600	0.7000	0.7700	12.8868 (77)						
Southwest		13.2000	36.7938	0.7600	0.7000	0.7700	179.0580 (79)						

Solar gains	223.3925	390.9657	562.6819	743.6959	875.4497	887.7905	848.1545	747.0057	624.9190	439.5813	269.4750	189.9465	(83)
Total gains	845.4982	1033.8911	1176.1774	1341.0143	1441.4780	1435.5419	1374.4031	1271.4804	1165.5435	995.3744	857.7679	797.2716	(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	40.9025	40.9985	41.0930	41.5430	41.6283	42.0301	42.0301	42.1053	41.8744	41.6283	41.4562	41.2777	
alpha	3.7268	3.7332	3.7395	3.7695	3.7752	3.8020	3.8020	3.8070	3.7916	3.7752	3.7637	3.7518	
util living area	0.9897	0.9781	0.9557	0.8967	0.7858	0.6179	0.4691	0.5213	0.7484	0.9289	0.9805	0.9917	(86)
MIT	19.1248	19.4144	19.8034	20.3021	20.6889	20.9103	20.9757	20.9639	20.8095	20.2871	19.6182	19.0796	(87)
Th 2	20.0740	20.0759	20.0779	20.0870	20.0887	20.0966	20.0966	20.0981	20.0935	20.0887	20.0852	20.0816	(88)
util rest of house	0.9876	0.9737	0.9467	0.8754	0.7429	0.5475	0.3795	0.4293	0.6856	0.9097	0.9759	0.9900	(89)
MIT 2	18.3501	18.6382	19.0221	19.5080	19.8604	20.0454	20.0872	20.0830	19.9723	19.5042	18.8491	18.3107	(90)
Living area fraction									fLA = Living area / (4) =			0.1285	(91)
MIT	18.4496	18.7379	19.1224	19.6100	19.9668	20.1565	20.2013	20.1961	20.0798	19.6048	18.9479	18.4095	(92)
Temperature adjustment												0.0000	(92)
adjusted MIT	18.4496	18.7379	19.1224	19.6100	19.9668	20.1565	20.2013	20.1961	20.0798	19.6048	18.9479	18.4095	(93)

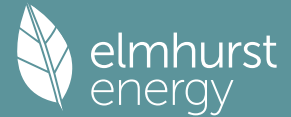
8. Space heating requirement

Utilisation	0.9825	0.9653	0.9348	0.8624	0.7365	0.5525	0.3902	0.4398	0.6846	0.8971	0.9681	0.9856	(94)
Useful gains	830.7081	997.9697	1099.5368	1156.4238	1061.6965	793.0652	536.3086	559.1386	797.8839	892.9124	830.3727	785.8133	(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	2205.5665	2151.9259	1958.3933	1643.6745	1266.1193	842.8856	546.2895	574.8180	910.4685	1379.1417	1822.1135	2194.7673	(97)
Space heating kWh	1022.8946	775.4585	638.9893	350.8205	152.0906	0.0000	0.0000	0.0000	0.0000	361.7545	714.0534	1048.2617	(98a)
Space heating requirement - total per year (kWh/year)												5064.3232	
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	1022.8946	775.4585	638.9893	350.8205	152.0906	0.0000	0.0000	0.0000	0.0000	361.7545	714.0534	1048.2617	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5064.3232	
Space heating per m2										(98c) / (4) =		32.8553	(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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1425.9116	1122.5261	1150.8045	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8333	0.8932	0.8637	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1188.1941	1002.6925	993.9202	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1593.4142	1525.6127	1408.9305	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	291.7585	389.0527	308.7676	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
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	1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	72.9396	97.2632	77.1919	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												
Energy for space heating												
Energy for space cooling												
Total												
Fabric Energy Efficiency (DFEE)												

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	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (5)

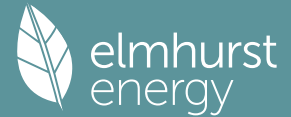
2. Ventilation rate

		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) =	0.1024 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3524	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)
Wind speed	Jan 5.1000, Feb 5.0000, Mar 4.9000, Apr 4.4000, May 4.3000, Jun 3.8000, Jul 3.8000, Aug 3.7000, Sep 4.0000, Oct 4.3000, Nov 4.5000, Dec 4.7000	(22)
Wind factor	1.2750, 1.2500, 1.2250, 1.1000, 1.0750, 0.9500, 0.9500, 0.9250, 1.0000, 1.0750, 1.1250, 1.1750	(22a)
Adj infiltr rate	0.3819, 0.3744, 0.3669, 0.3295, 0.3220, 0.2846, 0.2846, 0.2771, 0.2995, 0.3220, 0.3370, 0.3520	(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	0.5729, 0.5701, 0.5673, 0.5543, 0.5518, 0.5405, 0.5405, 0.5384, 0.5449, 0.5518, 0.5568, 0.5619	(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			5.0400	1.0000	5.0400		(26a)
TER Opening Type (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781		(28a)
Above Garage			9.1200	0.1300	1.1856		(28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588		(29a)
House to Garage Wall	16.5600		16.5600	0.1800	2.9808		(29a)
Main Roof	82.7700		82.7700	0.1100	9.1047		(30)
Total net area of external elements Aum(A, m2)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.3068		(33)
Party Wall			46.9600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9059 (35)
List of Thermal Bridges				Length	Psi-value	Total	
K1 Element				19.1000	0.0500	0.9550	
E2 Other lintels (including other steel lintels)				16.7000	0.0500	0.8350	
E3 Sill				35.7000	0.0500	1.7850	
E4 Jamb				27.1500	0.1600	4.3440	
E5 Ground floor (normal)				27.1000	0.0000	0.0000	
E6 Intermediate floor within a dwelling				10.1000	0.0900	0.9090	
E16 Corner (normal)				10.1000	0.0600	0.6060	
E18 Party wall between dwellings				2.4000	-0.0900	-0.2160	
E17 Corner (inverted - internal area greater than external area)				9.3000	0.0800	0.7440	
P1 Party wall - Ground floor							

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P2 Party wall - Intermediate floor within a dwelling	9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.3000	0.1200	1.1160
E10 Eaves (insulation at ceiling level)	27.1000	0.0600	1.6260
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.7040 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	82.0108 (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	73.8547	73.4897	73.1319	71.4512	71.1367	69.6729	69.6729	69.4018	70.2367	71.1367	71.7728	72.4379 (38)
Average = Sum(39)m / 12 =	155.8655	155.5005	155.1426	153.4619	153.1475	151.6837	151.6837	151.4126	152.2475	153.1475	153.7836	154.4487 (39)
												153.4604

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0112	1.0088	1.0065	0.9956	0.9936	0.9841	0.9841	0.9823	0.9877	0.9936	0.9977	1.0020 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9405 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.7400	31.2687	30.6049	29.3809	28.4644	27.4482	26.8993	27.5585	28.2762	29.3636	30.6127	31.6327	31.6327 (42b)
Hot water usage for other uses	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434	44.7434 (42c)
Average daily hot water use (litres/day)													70.1038 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	76.4834	74.3850	72.0942	69.2432	66.6997	64.0564	63.5075	65.7937	68.1385	70.8529	73.7291	76.3761 (44)	
Energy content (annual)	121.1311	105.9233	110.8061	94.7905	89.7906	78.7649	76.8068	81.4664	84.0215	96.1467	105.0406	119.5866 (45)	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Total heat required for water heating calculated for each month	102.9614	90.0348	94.1852	80.5719	76.3220	66.9501	65.2858	69.2464	71.4183	81.7247	89.2845	101.6486 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	102.9614	90.0348	94.1852	80.5719	76.3220	66.9501	65.2858	69.2464	71.4183	81.7247	89.2845	101.6486 (64)	
12Total per year (kWh/year)													989.6337 (64)
Electric shower(s)	58.8788	52.4615	57.2859	54.6673	55.6931	53.1258	54.8967	55.6931	54.6673	57.2859	56.2087	58.8788	58.8788 (64a)
Heat gains from water heating, kWh/month	40.4600	35.6241	37.8678	33.8098	33.0038	30.0190	30.0456	31.2349	31.5214	34.7527	36.3733	40.1318	40.1318 (65)
													669.7429 (64a)
													990 (64)

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	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237	147.0237 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.6263	194.4434	175.6263	181.4805	175.6263	181.4805	175.6263	175.6263	181.4805	175.6263	181.4805	175.6263 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.9905	328.3629	319.8646	301.7727	278.9350	257.4707	243.1313	239.7589	248.2572	266.3490	289.1868	310.6510 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024	37.7024 (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)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	54.3818	53.0120	50.8975	46.9580	44.3599	41.6930	40.3839	41.9824	43.7797	46.7106	50.5185	53.9407 (72)
Total internal gains	622.1057	642.9254	613.4955	597.3184	566.0283	547.7514	526.2486	524.4747	540.6245	555.7930	588.2929	607.3251 (73)

6. Solar gains

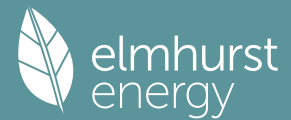
[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast		7.5600	11.2829	0.6300	0.7000	0.7700	26.0685 (75)
Southeast		0.9500	36.7938	0.6300	0.7000	0.7700	10.6824 (77)
Southwest		13.2000	36.7938	0.6300	0.7000	0.7700	148.4297 (79)

Solar gains	185.1806	324.0900	466.4337	616.4848	725.7017	735.9316	703.0755	619.2284	518.0250	364.3898	223.3806	157.4557 (83)
Total gains	807.2863	967.0154	1079.9292	1213.8031	1291.7300	1283.6830	1229.3240	1143.7031	1058.6495	920.1828	811.6735	764.7808 (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	

Full SAP Calculation Printout



tau	40.9048	41.0009	41.0954	41.5455	41.6308	42.0326	42.0326	42.1078	41.8769	41.6308	41.4586	41.2801
alpha	3.7270	3.7334	3.7397	3.7697	3.7754	3.8022	3.8022	3.8072	3.7918	3.7754	3.7639	3.7520
util living area	0.9912	0.9822	0.9655	0.9197	0.8274	0.6700	0.5172	0.5693	0.7882	0.9426	0.9836	0.9928 (86)
MIT	19.0860	19.3493	19.7170	20.2103	20.6207	20.8815	20.9662	20.9514	20.7691	20.2261	19.5728	19.0463 (87)
Th 2	20.0740	20.0760	20.0779	20.0870	20.0887	20.0966	20.0966	20.0981	20.0936	20.0887	20.0853	20.0817 (88)
util rest of house	0.9894	0.9786	0.9582	0.9019	0.7884	0.5990	0.4212	0.4726	0.7289	0.9263	0.9797	0.9913 (89)
MIT 2	18.3117	18.5742	18.9386	19.4238	19.8046	20.0273	20.0832	20.0773	19.9431	19.4477	18.8046	18.2777 (90)
Living area fraction									FLA = Living area / (4) =			0.1285 (91)
MIT	18.4112	18.6738	19.0386	19.5248	19.9094	20.1370	20.1966	20.1896	20.0492	19.5477	18.9033	18.3764 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4112	18.6738	19.0386	19.5248	19.9094	20.1370	20.1966	20.1896	20.0492	19.5477	18.9033	18.3764 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9848	0.9712	0.9475	0.8888	0.7798	0.6024	0.4323	0.4829	0.7256	0.9141	0.9727	0.9873 (94)
Useful gains	794.9859	939.1236	1023.2602	1078.7943	1007.2501	773.3352	531.4426	552.3167	768.2023	841.1726	789.4983	755.1003 (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	2199.4419	2141.8291	1945.2650	1630.5013	1257.2553	839.8794	545.5491	573.7857	905.7492	1370.3209	1815.1484	2189.5324 (97)
Space heating kWh	1044.9153	808.2181	685.9715	397.2291	186.0039	0.0000	0.0000	0.0000	0.0000	393.6863	738.4681	1067.2175 (98a)
Space heating requirement - total per year (kWh/year)												5321.7098
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	1044.9153	808.2181	685.9715	397.2291	186.0039	0.0000	0.0000	0.0000	0.0000	393.6863	738.4681	1067.2175 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5321.7098
Space heating per m2												(98c) / (4) = 34.5252 (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	1425.8264	1122.4591	1150.7356	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7890	0.8593	0.8262	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9641	964.5220	950.7010	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1415.9168	1356.0398	1259.5804	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	209.4860	291.2892	229.8063	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	52.3715	72.8223	57.4516	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												182.6454 (107)
Energy for space heating												34.5252 (99)
Energy for space cooling												1.1849 (108)
Total												35.7101 (109)
Fabric Energy Efficiency (TFEE)												35.7 (109)

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

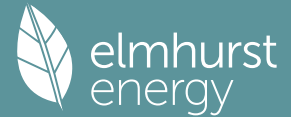
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	390.6285 (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	5 * 10 = 50.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	50.0000 / (5) = 0.1280 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3780 (18)

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Number of sides sheltered

2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3213 (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												
Effective ac	0.4097	0.4016	0.3936	0.3534	0.3454	0.3052	0.3052	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
	0.5839	0.5807	0.5775	0.5625	0.5596	0.5466	0.5466	0.5442	0.5516	0.5596	0.5653	0.5713 (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
Entrance Door			5.0400	1.0000	5.0400		(26a)
Windows (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000 (28a)
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000 (28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000 (29a)
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000 (29a)
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300 (30)
Total net area of external elements Aum(A, m2)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 68.8767		(33)
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000 (32)
Internal Walls			256.2100			9.0000	2305.8900 (32c)
Internal Floor			73.6500			18.0000	1325.7000 (32d)
Internal Ceiling			71.3700			9.0000	642.3300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22952.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 148.9059 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.1000	0.0200	0.3820
E3 Sill	16.7000	0.0290	0.4843
E4 Jamb	35.7000	0.0160	0.5712
E5 Ground floor (normal)	27.1500	0.0670	1.8191
E6 Intermediate floor within a dwelling	27.1000	0.0040	0.1084
E16 Corner (normal)	10.1000	0.0480	0.4848
E18 Party wall between dwellings	10.1000	0.0940	0.9494
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0750	-0.1800
P1 Party wall - Ground floor	9.3000	0.3200	2.9760
P2 Party wall - Intermediate floor within a dwelling	9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.3000	0.4800	4.4640
E10 Eaves (insulation at ceiling level)	27.1000	0.0400	1.0840

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.1432 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 82.0198 (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	75.2702	74.8502	74.4385	72.5047	72.1429	70.4587	70.4587	70.1468	71.1075	72.1429	72.8749	73.6400 (38)
Average = Sum(39)m / 12 =	157.2900	156.8700	156.4583	154.5246	154.1628	152.4786	152.4786	152.1667	153.1273	154.1628	154.8947	155.6599 (39)
												154.5228

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0204	1.0177	1.0150	1.0025	1.0001	0.9892	0.9892	0.9872	0.9934	1.0001	1.0049	1.0099 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9405 (42)											
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	84.8140	83.5544	81.7806	78.5101	76.0611	73.3456	71.8788	73.6402	75.5580	78.4637	81.8016	84.5273 (42b)
Hot water usage for other uses	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434 (42c)
Average daily hot water use (litres/day)												119.3118 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	129.5574	126.6707	123.2699	118.3723	114.2964	109.9538	108.4871	111.8755	115.4203	119.9530	124.9180	129.2707 (44)
Energy conte	205.1872	180.3775	189.4613	162.0458	153.8649	135.2011	131.2057	138.5252	142.3248	162.7751	177.9685	202.4066 (45)
Energy content (annual)												Total = Sum(45)m = 1981.3437
Distribution loss (46)m = 0.15 x (45)m	30.7781	27.0566	28.4192	24.3069	23.0797	20.2802	19.6809	20.7788	21.3487	24.4163	26.6953	30.3610 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2096 (55)
Total storage loss	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (56)
If cylinder contains dedicated solar storage	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666 (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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666 (64)
												Total per year (kWh/year) = Sum(64)m = 2696.7437 (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)

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Heat gains from water heating, kWh/month
 116.8328 103.8795 111.6039 100.9202 99.7681 91.9944 92.2339 94.6676 94.3630 102.7307 106.2145 115.9082 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.8209	62.0143	50.4334	38.1813	28.5410	24.0955	26.0360	33.8426	45.4235	57.6756	67.3159	71.7614 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.0604	490.0938	477.4098	450.4070	416.3208	384.2846	362.8825	357.8491	370.5331	397.5359	431.6221	463.6583 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	157.0333	154.5826	150.0052	140.1670	134.0969	127.7699	123.9703	127.2414	131.0597	138.0789	147.5202	155.7906 (72)
Total internal gains	829.3073	824.0835	795.2412	746.1481	696.3515	650.5428	627.2816	633.3259	661.4091	710.6832	763.8510	808.6030 (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						
Northeast	7.5600	11.2829	0.7600	0.7000	0.7700	31.4477 (75)						
Southeast	0.9500	36.7938	0.7600	0.7000	0.7700	12.8868 (77)						
Southwest	13.2000	36.7938	0.7600	0.7000	0.7700	179.0580 (79)						
Solar gains	223.3925	390.9657	562.6819	743.6959	875.4497	887.7905	848.1545	747.0057	624.9190	439.5813	269.4750	189.9465 (83)
Total gains	1052.6998	1215.0492	1357.9231	1489.8440	1571.8012	1538.3333	1475.4361	1380.3316	1286.3281	1150.2645	1033.3259	998.5496 (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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.5344	40.6429	40.7498	41.2598	41.3566	41.8134	41.8134	41.8991	41.6363	41.3566	41.1612	40.9589
alpha	3.7023	3.7095	3.7167	3.7507	3.7571	3.7876	3.7876	3.7933	3.7758	3.7571	3.7441	3.7306
util living area	0.9794	0.9645	0.9346	0.8687	0.7520	0.5877	0.4419	0.4873	0.7068	0.8978	0.9656	0.9828 (86)
MIT	19.6494	19.8409	20.1220	20.4584	20.7169	20.8611	20.9034	20.8968	20.8004	20.4622	19.9962	19.6160 (87)
Th 2	20.0663	20.0686	20.0708	20.0813	20.0832	20.0923	20.0923	20.0940	20.0888	20.0832	20.0793	20.0751 (88)
util rest of house	0.9754	0.9578	0.9221	0.8437	0.7066	0.5182	0.3560	0.3991	0.6417	0.8727	0.9580	0.9794 (89)
MIT 2	18.4786	18.7220	19.0752	19.4935	19.7916	19.9464	19.9804	19.9782	19.8900	19.5084	18.9290	18.4429 (90)
Living area fraction	18.6290	18.8657	19.2097	19.6174	19.9105	20.0639	20.0990	20.0962	20.0069	19.6309	19.0661	18.5936 (92)
Temperature adjustment	18.6290	18.8657	19.2097	19.6174	19.9105	20.0639	20.0990	20.0962	20.0069	19.6309	19.0661	18.5936 (93)
adjusted MIT	18.6290	18.8657	19.2097	19.6174	19.9105	20.0639	20.0990	20.0962	20.0069	19.6309	19.0661	18.5936 (93)

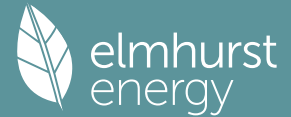
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9673	0.9467	0.9079	0.8291	0.6972	0.5159	0.3567	0.3993	0.6353	0.8579	0.9470	0.9722 (94)
Useful gains	1018.2468	1150.2480	1232.9105	1235.2420	1095.8701	793.5964	526.2326	551.2219	817.2418	986.7579	978.6083	970.7920 (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	2253.8107	2190.8008	1988.5353	1656.1065	1265.7475	833.1216	533.5162	562.4331	904.5103	1392.2258	1853.4864	2240.5030 (97)
Space heating kWh	919.2595	699.2515	562.1848	303.0225	126.3887	0.0000	0.0000	0.0000	0.0000	301.6681	629.9122	944.6650 (98a)
Space heating requirement - total per year (kWh/year)												4486.3523
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	919.2595	699.2515	562.1848	303.0225	126.3887	0.0000	0.0000	0.0000	0.0000	301.6681	629.9122	944.6650 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4486.3523
Space heating per m ²												(98c) / (4) = 29.1057 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	919.2595	699.2515	562.1848	303.0225	126.3887	0.0000	0.0000	0.0000	0.0000	301.6681	629.9122	944.6650 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	540.7409	411.3244	330.6970	178.2485	74.3463	0.0000	0.0000	0.0000	0.0000	177.4518	370.5366	555.6853 (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)												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666	(64)	
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)	
Fuel for water heating, kWh/month	156.4395	138.3867	147.1890	129.9093	126.2499	114.1183	112.9210	117.2266	118.3087	131.4913	139.2756	154.8039	(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	61.1138	49.0278	44.1441	32.3418	24.9818	20.4103	22.7892	29.6223	38.4764	50.4831	57.0206	62.8123	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-36.2691	-56.9704	-90.3629	-108.5885	-119.4529	-108.2226	-106.7313	-97.9019	-82.3323	-66.7327	-41.3955	-30.6455	(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	-7.8123	-18.5986	-42.8081	-74.9541	-110.6509	-119.1192	-117.1550	-95.6756	-65.8888	-31.1717	-11.3085	-5.9503	(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												2639.0307	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												170.0000		
Water heating fuel used												1586.3198	(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)												493.2234	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1646.6987	(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													3071.8753	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2639.0307	16.4900	435.1762	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1586.3198	16.4900	261.5841	(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	493.2234	16.4900	81.3325	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-945.6056	16.4900	-155.9304	
PV Unit electricity exported	-701.0932	5.5900	-39.1911	
Total			-195.1215	(252)
Total energy cost			582.9714	(255)

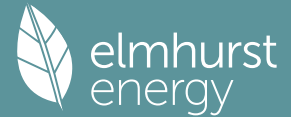
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0539	(257)
SAP value		82.9166	
SAP rating (Section 12)		83	(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	2639.0307	0.1556	410.5137	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1586.3198	0.1408	223.3414	(264)
Space and water heating			633.8551	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	493.2234	0.1443	71.1874	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-945.6056	0.1336	-126.3136	
PV Unit electricity exported	-701.0932	0.1216	-85.2338	
Total			-211.5475	(269)
Total CO2, kg/year			493.4950	(272)
CO2 emissions per m2			3.2000	(273)
EI value			96.6793	
EI rating			97	(274)
EI band			A	

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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	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (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	5 * 10 = 50.0000 (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) =	50.0000 / (5) = 0.1280 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3780 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3213 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.2000	6.0000	6.0000	5.4000	5.2000	4.6000	4.5000	4.4000	4.8000	5.6000	5.7000	6.0000 (22)
Wind factor	1.5500	1.5000	1.5000	1.3500	1.3000	1.1500	1.1250	1.1000	1.2000	1.4000	1.4250	1.5000 (22a)
Adj infilt rate												
Effective ac	0.4980	0.4819	0.4819	0.4338	0.4177	0.3695	0.3615	0.3534	0.3856	0.4498	0.4579	0.4819 (22b)
	0.6240	0.6161	0.6161	0.5941	0.5872	0.5683	0.5653	0.5625	0.5743	0.6012	0.6048	0.6161 (25)

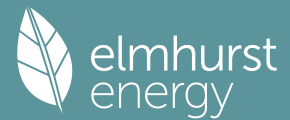
3. Heat losses and heat loss parameter

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
Entrance Door			5.0400	1.0000	5.0400		(26a)
Windows (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000 (28a)
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000 (28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000 (29a)
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000 (29a)
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300 (30)
Total net area of external elements Aum(A, m2)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.8767		(33)
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000 (32)
Internal Walls			256.2100			9.0000	2305.8900 (32c)
Internal Floor			73.6500			18.0000	1325.7000 (32d)
Internal Ceiling			71.3700			9.0000	642.3300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22952.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9059 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	19.1000	0.0200	0.3820
E3 Sill	16.7000	0.0290	0.4843
E4 Jamb	35.7000	0.0160	0.5712
E5 Ground floor (normal)	27.1500	0.0670	1.8191
E6 Intermediate floor within a dwelling	27.1000	0.0040	0.1084
E16 Corner (normal)	10.1000	0.0480	0.4848
E18 Party wall between dwellings	10.1000	0.0940	0.9494
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0750	-0.1800
P1 Party wall - Ground floor	9.3000	0.3200	2.9760
P2 Party wall - Intermediate floor within a dwelling	9.3000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.3000	0.4800	4.4640
E10 Eaves (insulation at ceiling level)	27.1000	0.0400	1.0840
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.1432 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 82.0198 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	80.4393	79.4246	79.4246	76.5802	75.6985	73.2533	72.8749	72.5047	74.0351	77.4951	77.9650	79.4246 (38)
Heat transfer coeff	162.4592	161.4445	161.4445	158.6000	157.7184	155.2731	154.8947	154.5246	156.0549	159.5149	159.9848	161.4445 (39)
Average = Sum(39)m / 12 =												158.6132
HLP	1.0540	1.0474	1.0474	1.0289	1.0232	1.0074	1.0049	1.0025	1.0124	1.0349	1.0379	1.0474 (40)
HLP (average)												1.0290
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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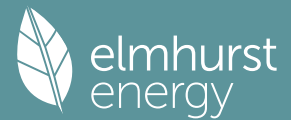
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.9405 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												84.5273 (42b)
Hot water usage for other uses												44.7434 (42c)
Average daily hot water use (litres/day)												119.3118 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	129.5574	126.6707	123.2699	118.3723	114.2964	109.9538	108.4871	111.8755	115.4203	119.9530	124.9180	129.2707 (44)
Distribution loss (46)m = 0.15 x (45)m	205.1872	180.3775	189.4613	162.0458	153.8649	135.2011	131.2057	138.5252	142.3248	162.7751	177.9685	202.4066 (45)
Water storage loss:												1981.3437
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2096 (55)
Total storage loss												37.4976 (56)
If cylinder contains dedicated solar storage												37.4976 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												265.9472 (62)
WWHRs												0.0000 (63a)
PV diverter												-0.0000 (63b)
Solar input												0.0000 (63c)
FGHRs												0.0000 (63d)
Output from w/h												265.9472 (64)
Electric shower(s)												0.0000 (64a)
Heat gains from water heating, kWh/month												116.8328 (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	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.8209	62.0143	50.4334	38.1813	28.5410	24.0955	26.0360	33.8426	45.4235	57.6756	67.3159	71.7614 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.0604	490.0938	477.4098	450.4070	416.3208	384.2846	362.8825	357.8491	370.5331	397.5359	431.6221	463.6583 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	157.0333	154.5826	150.0052	140.1670	134.0969	127.7699	123.9703	127.2414	131.0597	138.0789	147.5202	155.7906 (72)
Total internal gains	829.3073	824.0835	795.2412	746.1481	696.3515	650.5428	627.2816	633.3259	661.4091	710.6832	763.8510	808.6030 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Northeast	7.5600	15.4404	0.7600	0.7000	0.7700	43.0354 (75)						
Southeast	0.9500	46.8814	0.7600	0.7000	0.7700	16.4199 (77)						
Southwest	13.2000	46.8814	0.7600	0.7000	0.7700	228.1496 (79)						
Solar gains	287.6049	433.0949	621.8274	847.0953	941.8353	1044.4360	912.3397	859.7285	731.1445	506.3653	334.4591	235.2965 (83)
Total gains	1116.9122	1257.1784	1417.0686	1593.2434	1638.1868	1694.9788	1539.6213	1493.0544	1392.5536	1217.0485	1098.3101	1043.8995 (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	39.2446	39.4913	39.4913	40.1996	40.4243	41.0609	41.1612	41.2598	40.8552	39.9690	39.8516	39.4913
alpha	3.6163	3.6328	3.6328	3.6800	3.6950	3.7374	3.7441	3.7507	3.7237	3.6646	3.6568	3.6328
util living area	0.9649	0.9478	0.9152	0.8501	0.7550	0.5915	0.5083	0.5040	0.6641	0.8524	0.9373	0.9679 (86)
MIT	19.8835	20.0217	20.2194	20.4814	20.6965	20.8502	20.8871	20.8894	20.8210	20.5756	20.2372	19.9044 (87)
Th 2	20.0386	20.0440	20.0440	20.0593	20.0640	20.0772	20.0793	20.0813	20.0730	20.0544	20.0519	20.0440 (88)
util rest of house	0.9574	0.9371	0.8985	0.8224	0.7106	0.5272	0.4289	0.4219	0.5952	0.8154	0.9219	0.9607 (89)
MIT 2	18.7553	18.9313	19.1746	19.5006	19.7509	19.9202	19.9551	19.9592	19.8931	19.6172	19.2098	18.7868 (90)
Living area fraction	18.9002	19.0714	19.3088	19.6266	19.8724	20.0397	20.0748	20.0787	20.0123	19.7403	19.3417	18.9303 (91)
MIT	18.9002	19.0714	19.3088	19.6266	19.8724	20.0397	20.0748	20.0787	20.0123	19.7403	19.3417	18.9303 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9002	19.0714	19.3088	19.6266	19.8724	20.0397	20.0748	20.0787	20.0123	19.7403	19.3417	18.9303 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9459	0.9235	0.8830	0.8079	0.7007	0.5245	0.4285	0.4217	0.5903	0.8010	0.9074	0.9498	(94)
Useful gains	1056.4742	1161.0008	1251.3125	1287.1040	1147.8340	888.9828	659.7101	629.6112	822.0672	974.8685	996.6025	991.4741	(95)
Ext temp.	6.3000	6.6000	7.5000	9.0000	11.4000	14.0000	15.7000	15.9000	14.3000	11.8000	9.2000	6.8000	(96)
Heat loss rate W	2047.0182	2013.4358	1906.4607	1685.3808	1336.2522	937.7992	677.6400	645.7109	891.4365	1266.6007	1622.5258	1958.3741	(97)
Space heating kWh	736.9648	572.8363	487.4303	286.7593	140.1831	0.0000	0.0000	0.0000	0.0000	217.0487	450.6648	719.3736	(98a)
Space heating requirement - total per year (kWh/year)												3611.2609	
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	736.9648	572.8363	487.4303	286.7593	140.1831	0.0000	0.0000	0.0000	0.0000	217.0487	450.6648	719.3736	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3611.2609	
Space heating per m2										(98c) / (4) =		23.4284	(99)

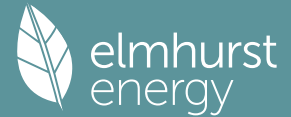
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													170.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	736.9648	572.8363	487.4303	286.7593	140.1831	0.0000	0.0000	0.0000	0.0000	217.0487	450.6648	719.3736	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	433.5087	336.9625	286.7237	168.6819	82.4607	0.0000	0.0000	0.0000	0.0000	127.6757	265.0969	423.1610	(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	265.9472	235.2575	250.2213	220.8458	214.6249	194.0011	191.9657	199.2852	201.1248	223.5351	236.7685	263.1666	(64)	
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	156.4395	138.3867	147.1890	129.9093	126.2499	114.1183	112.9210	117.2266	118.3087	131.4913	139.2756	154.8039	(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	61.1138	49.0278	44.1441	32.3418	24.9818	20.4103	22.7892	29.6223	38.4764	50.4831	57.0206	62.8123	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-46.3096	-63.0634	-98.7486	-119.9906	-126.4344	-119.5670	-111.8763	-107.7703	-93.0039	-75.2272	-50.5078	-37.8533	(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	-12.4199	-23.4005	-52.1715	-91.9842	-122.4922	-148.5515	-129.8545	-117.2587	-84.0583	-41.0168	-17.1659	-9.0626	(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													2124.2711	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.0000	
Water heating fuel used													1586.3198	(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)													493.2234	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1899.7889	(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													2304.0255	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2124.2711	21.5100	456.9307	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1586.3198	21.5100	341.2174	(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	493.2234	21.5100	106.0924	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1050.3524	21.5100	-225.9308	

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PV Unit electricity exported	-849.4365	5.5900	-47.4835
Total			-273.4143 (252)
Total energy cost			630.8262 (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	2124.2711	0.1553	329.8197 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1586.3198	0.1408	223.3414 (264)
Space and water heating			553.1611 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	493.2234	0.1443	71.1874 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1050.3524	0.1341	-140.8059
PV Unit electricity exported	-849.4365	0.1225	-104.0767
Total			-244.8826 (269)
Total CO2, kg/year			379.4659 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2124.2711	1.5748	3345.3428 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1586.3198	1.5206	2412.1467 (278)
Space and water heating			5757.4895 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	493.2234	1.5338	756.5225 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1050.3524	1.4954	-1570.7127
PV Unit electricity exported	-849.4365	0.4496	-381.8712
Total			-1952.5839 (283)
Total Primary energy kWh/year			4561.4282 (286)

SAP 10 EPC IMPROVEMENTS

Plot 01

Current energy efficiency rating: B 83
 Current environmental impact rating: A 97

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 81	-50 kg (13.2%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£81	0.33 kg/m ²	B 84	A 97
Total Savings	£81	0.33 kg/m²		

Potential energy efficiency rating: B 84
 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)

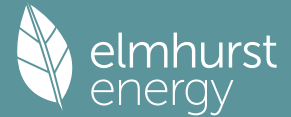
Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£904	£818	£86
Space heating	£457	£475	-£18
Water heating	£341	£237	£104
Lighting	£106	£106	£0
Generated (PV)	-£273	-£268	-£5
Total cost of fuels	£631	£550	£81
Total cost of uses	£631	£550	£81
Delivered energy	15 kWh/m ²	12 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.3 tonnes	0.1 tonnes
CO2 emissions per m ²	2 kg/m ²	2 kg/m ²	0 kg/m ²
Primary energy	30 kWh/m ²	26 kWh/m ²	4 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

Full SAP Calculation Printout



	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 390.6285 (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	5 * 10 =	50.0000 (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) =	50.0000 / (5) = 0.1280 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3780 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3213 (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												
Effective ac	0.4097	0.4016	0.3936	0.3534	0.3454	0.3052	0.3052	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
	0.5839	0.5807	0.5775	0.5625	0.5596	0.5466	0.5466	0.5442	0.5516	0.5596	0.5653	0.5713 (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
Entrance Door			5.0400	1.0000	5.0400		(26a)
Windows (Uw = 1.20)			21.7100	1.1450	24.8588		(27)
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000 (28a)
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000 (28b)
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000 (29a)
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000 (29a)
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300 (30)
Total net area of external elements Aum(A, m ²)			300.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.8767		(33)
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000 (32)
Internal Walls			256.2100			9.0000	2305.8900 (32c)
Internal Floor			73.6500			18.0000	1325.7000 (32d)
Internal Ceiling			71.3700			9.0000	642.3300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22952.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.9059 (35)

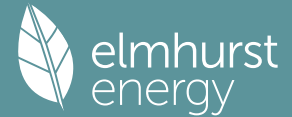
List of Thermal Bridges	Length	Psi-value	Total
K1 Element	19.1000	0.0200	0.3820
E2 Other lintels (including other steel lintels)	16.7000	0.0290	0.4843
E3 Sill	35.7000	0.0160	0.5712
E4 Jamb	27.1500	0.0670	1.8191
E5 Ground floor (normal)	27.1000	0.0040	0.1084
E6 Intermediate floor within a dwelling	10.1000	0.0480	0.4848
E16 Corner (normal)	10.1000	0.0940	0.9494
E18 Party wall between dwellings	2.4000	-0.0750	-0.1800
E17 Corner (inverted - internal area greater than external area)	9.3000	0.3200	2.9760
P1 Party wall - Ground floor	9.3000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	9.3000	0.4800	4.4640
P4 Party wall - Roof (insulation at ceiling level)	27.1000	0.0400	1.0840
E10 Eaves (insulation at ceiling level)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.1432 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 82.0198 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	75.2702	74.8502	74.4385	72.5047	72.1429	70.4587	70.4587	70.1468	71.1075	72.1429	72.8749	73.6400 (38)
Heat transfer coeff	157.2900	156.8700	156.4583	154.5246	154.1628	152.4786	152.4786	152.1667	153.1273	154.1628	154.8947	155.6599 (39)
Average = Sum(39)m / 12 =												154.5228
HLP	1.0204	1.0177	1.0150	1.0025	1.0001	0.9892	0.9892	0.9872	0.9934	1.0001	1.0049	1.0099 (40)
HLP (average)												1.0025
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9405 (42)											
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	84.8140	83.5544	81.7806	78.5101	76.0611	73.3456	71.8788	73.6402	75.5580	78.4637	81.8016	84.5273 (42b)
Hot water usage for other uses	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434 (42c)

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Average daily hot water use (litres/day)												119.3118 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	129.5574	126.6707	123.2699	118.3723	114.2964	109.9538	108.4871	111.8755	115.4203	119.9530	124.9180	129.2707 (44)
Energy content	205.1872	180.3775	189.4613	162.0458	153.8649	135.2011	131.2057	138.5252	142.3248	162.7751	177.9685	202.4066 (45)
Energy content (annual)	Total = Sum(45)m =											1981.3437
Distribution loss (46)m = 0.15 x (45)m	30.7781	27.0566	28.4192	24.3069	23.0797	20.2802	19.6809	20.7788	21.3487	24.4163	26.6953	30.3610 (46)
Water storage loss:												200.0000 (47)
Store volume												2.2400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.2096 (55)
Enter (49) or (54) in (55)												
Total storage loss	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (56)
If cylinder contains dedicated solar storage	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976 (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	265.9472	235.2575	248.8255	214.0922	201.8306	181.3943	178.9387	187.1888	195.7219	222.1394	236.7685	263.1666 (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												621.3376 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												621.3376
Solar input	-0.0000	-16.2129	-58.2258	-80.0159	-104.4713	-96.4063	-95.8215	-83.7472	-57.7699	-28.6668	-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	265.9472	219.0445	190.5997	134.0764	97.3593	84.9880	83.1172	103.4416	137.9520	193.4726	236.7685	263.1666 (64)
Electric shower(s)												2009.9338 (64)
Heat gains from water heating, kWh/month	116.8328	103.8795	110.4873	95.5174	89.5326	81.9090	81.8123	84.9905	90.0407	101.6141	106.2145	115.9082 (65)

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

Metabolic gains (Table 5), Watts	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284 (66)
(66)m	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.8209	62.0143	50.4334	38.1813	28.5410	24.0955	26.0360	33.8426	45.4235	57.6756	67.3159	71.7614 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.0604	490.0938	477.4098	450.4070	416.3208	384.2846	362.8825	357.8491	370.5331	397.5359	431.6221	463.6583 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	157.0333	154.5826	148.5044	132.6630	120.3395	113.7625	109.9628	114.2345	125.0565	136.5781	147.5202	155.7906 (72)
Total internal gains	829.3073	824.0835	793.7404	738.6441	682.5941	636.5354	613.2741	620.3190	655.4059	709.1824	763.8510	808.6030 (73)

6. Solar gains												

[Jan]												
			Area	Solar flux								
			m2	Table 6a	g							
				W/m2	Specific data	Specific data	FF	Access				Gains
					or Table 6b	or Table 6c		Factor				W
								Table 6d				
Northeast			7.5600	11.2829	0.7600	0.7000	0.7700					31.4477 (75)
Southeast			0.9500	36.7938	0.7600	0.7700						12.8868 (77)
Southwest			13.2000	36.7938	0.7600	0.7700						179.0580 (79)

Solar gains	223.3925	390.9657	562.6819	743.6959	875.4497	887.7905	848.1545	747.0057	624.9190	439.5813	269.4750	189.9465 (83)
Total gains	1052.6998	1215.0492	1356.4223	1482.3400	1558.0438	1524.3259	1461.4286	1367.3247	1280.3249	1148.7637	1033.3259	998.5496 (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	40.5344	40.6429	40.7498	41.2598	41.3566	41.8134	41.8134	41.8991	41.6363	41.3566	41.1612	40.9589
alpha	3.7023	3.7095	3.7167	3.7507	3.7571	3.7876	3.7876	3.7933	3.7758	3.7571	3.7441	3.7306
util living area	0.9794	0.9645	0.9348	0.8702	0.7558	0.5920	0.4457	0.4914	0.7089	0.8981	0.9656	0.9828 (86)
MIT	19.6494	19.8409	20.1211	20.4549	20.7133	20.8596	20.9029	20.8962	20.7991	20.4614	19.9962	19.6160 (87)
Th 2	20.0663	20.0686	20.0708	20.0813	20.0832	20.0923	20.0923	20.0940	20.0888	20.0832	20.0793	20.0751 (88)
util rest of house	0.9754	0.9578	0.9223	0.8454	0.7105	0.5222	0.3593	0.4027	0.6439	0.8731	0.9580	0.9794 (89)
MIT 2	18.4786	18.7220	19.0741	19.4896	19.7879	19.9453	19.9802	19.9778	19.8889	19.5075	18.9290	18.4429 (90)
Living area fraction												0.1285 (91)
MIT	18.6290	18.8657	19.2086	19.6136	19.9068	20.0627	20.0987	20.0958	20.0058	19.6300	19.0661	18.5936 (92)
Temperature adjustment												0.0000

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adjusted MIT 18.6290 18.8657 19.2086 19.6136 19.9068 20.0627 20.0987 20.0958 20.0058 19.6300 19.0661 18.5936 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9673	0.9467	0.9082	0.8308	0.7010	0.5198	0.3599	0.4029	0.6374	0.8582	0.9470	0.9722	(94)
Useful gains	1018.2468	1150.2480	1231.8661	1231.4658	1092.1560	792.4043	525.9654	550.8270	816.1051	985.9077	978.6083	970.7920	(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	2253.8107	2190.8008	1988.3666	1655.5094	1265.1826	832.9477	533.4763	562.3745	904.3399	1392.0905	1853.4864	2240.5030	(97)
Space heating kWh	919.2595	699.2515	562.8364	305.3114	128.7318	0.0000	0.0000	0.0000	0.0000	302.2000	629.9122	944.6650	(98a)
Space heating requirement - total per year (kWh/year)												4492.1678	
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	919.2595	699.2515	562.8364	305.3114	128.7318	0.0000	0.0000	0.0000	0.0000	302.2000	629.9122	944.6650	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4492.1678	
Space heating per m2										(98c) / (4) =		29.1434	(99)

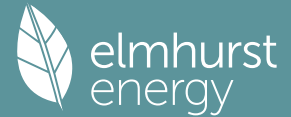
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)													170.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	919.2595	699.2515	562.8364	305.3114	128.7318	0.0000	0.0000	0.0000	0.0000	302.2000	629.9122	944.6650	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	540.7409	411.3244	331.0802	179.5950	75.7246	0.0000	0.0000	0.0000	0.0000	177.7647	370.5366	555.6853	(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	265.9472	219.0445	190.5997	134.0764	97.3593	84.9880	83.1172	103.4416	137.9520	193.4726	236.7685	263.1666	(64)	
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	156.4395	128.8497	112.1175	78.8684	57.2702	49.9930	48.8925	60.8480	81.1482	113.8074	139.2756	154.8039	(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	61.1138	49.0278	44.1441	32.3418	24.9818	20.4103	22.7892	29.6223	38.4764	50.4831	57.0206	62.8123	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.2906	-56.9407	-89.7937	-106.6740	-114.7544	-102.2624	-100.8259	-93.7023	-80.5440	-66.5255	-41.4328	-30.6620	(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	-7.7908	-18.6282	-43.3773	-76.8686	-115.3494	-125.0795	-123.0604	-99.8752	-67.6772	-31.3789	-11.2712	-5.9338	(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													2642.4516	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.0000	
Water heating fuel used													1182.3140	(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)													493.2234	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1646.6987	(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													2751.2903	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2642.4516	16.4900	435.7403	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1182.3140	16.4900	194.9636	(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)

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Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	493.2234	16.4900	81.3325 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.4083	16.4900	-151.7753
PV Unit electricity exported	-726.2904	5.5900	-40.5996
Total			-192.3750 (252)
Total energy cost			532.8534 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9633 (257)
SAP value		84.3853
SAP rating (Section 12)		84 (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	2642.4516	0.1555	410.9894 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1182.3140	0.1455	171.9902 (264)
Space and water heating			582.9796 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	493.2234	0.1443	71.1874 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-920.4083	0.1339	-123.2522
PV Unit electricity exported	-726.2904	0.1212	-88.0153
Total			-211.2675 (269)
Total CO2, kg/year			453.9964 (272)
CO2 emissions per m2			2.9500 (273)
EI value			96.9451
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	71.3700 (1b)	x 2.4000 (2b)	= 171.2880 (1b) - (3b)
First floor	82.7700 (1c)	x 2.6500 (2c)	= 219.3405 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	154.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	390.6285 (5)

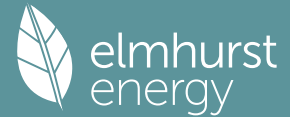
2. Ventilation rate

		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	5 * 10 =	50.0000 (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) =	50.0000 / (5) =	0.1280 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3780 (18)	
Number of sides sheltered	2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3213 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.2000	6.0000	6.0000	5.4000	5.2000	4.6000	4.5000	4.4000	4.8000	5.6000	5.7000	6.0000 (22)
Wind factor	1.5500	1.5000	1.5000	1.3500	1.3000	1.1500	1.1250	1.1000	1.2000	1.4000	1.4250	1.5000 (22a)
Adj infilt rate	0.4980	0.4819	0.4819	0.4338	0.4177	0.3695	0.3615	0.3534	0.3856	0.4498	0.4579	0.4819 (22b)
Effective ac	0.6240	0.6161	0.6161	0.5941	0.5872	0.5683	0.5653	0.5625	0.5743	0.6012	0.6048	0.6161 (25)

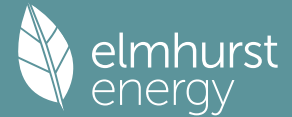
3. Heat losses and heat loss parameter

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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						
Entrance Door			5.0400	1.0000	5.0400			(26a)					
Windows (Uw = 1.20)			21.7100	1.1450	24.8588			(27)					
Ground Floor			71.3700	0.1300	9.2781	110.0000	7850.7000	(28a)					
Above Garage			9.1200	0.1192	1.0867	20.0000	182.4000	(28b)					
Cavity Wall	120.4100	26.7500	93.6600	0.1800	16.8588	60.0000	5619.6000	(29a)					
House to Garage Wall	16.5600		16.5600	0.1600	2.6496	60.0000	993.6000	(29a)					
Main Roof	82.7700		82.7700	0.1100	9.1047	9.0000	744.9300	(30)					
Total net area of external elements Aum(A, m2)			300.2300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.8767			(33)					
Party Wall			46.9600	0.0000	0.0000	70.0000	3287.2000	(32)					
Internal Walls			256.2100			9.0000	2305.8900	(32c)					
Internal Floor			73.6500			18.0000	1325.7000	(32d)					
Internal Ceiling			71.3700			9.0000	642.3300	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	22952.3500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								148.9059 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				19.1000	0.0200		0.3820						
E3 Sill				16.7000	0.0290		0.4843						
E4 Jamb				35.7000	0.0160		0.5712						
E5 Ground floor (normal)				27.1500	0.0670		1.8191						
E6 Intermediate floor within a dwelling				27.1000	0.0040		0.1084						
E16 Corner (normal)				10.1000	0.0480		0.4848						
E18 Party wall between dwellings				10.1000	0.0940		0.9494						
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0750		-0.1800						
P1 Party wall - Ground floor				9.3000	0.3200		2.9760						
P2 Party wall - Intermediate floor within a dwelling				9.3000	0.0000		0.0000						
P4 Party wall - Roof (insulation at ceiling level)				9.3000	0.4800		4.4640						
E10 Eaves (insulation at ceiling level)				27.1000	0.0400		1.0840						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								13.1432 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	82.0198 (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	80.4393	79.4246	79.4246	76.5802	75.6985	73.2533	72.8749	72.5047	74.0351	77.4951	77.9650	79.4246	(38)
Average = Sum(39)m / 12 =	162.4592	161.4445	161.4445	158.6000	157.7184	155.2731	154.8947	154.5246	156.0549	159.5149	159.9848	161.4445	(39)
	158.6132												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0540	1.0474	1.0474	1.0289	1.0232	1.0074	1.0049	1.0025	1.0124	1.0349	1.0379	1.0474	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.9405 (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													
	84.8140	83.5544	81.7806	78.5101	76.0611	73.3456	71.8788	73.6402	75.5580	78.4637	81.8016	84.5273	(42b)
Hot water usage for other uses													
	44.7434	43.1164	41.4893	39.8623	38.2353	36.6082	36.6082	38.2353	39.8623	41.4893	43.1164	44.7434	(42c)
Average daily hot water use (litres/day)													119.3118 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	129.5574	126.6707	123.2699	118.3723	114.2964	109.9538	108.4871	111.8755	115.4203	119.9530	124.9180	129.2707	(44)
Energy conte	205.1872	180.3775	189.4613	162.0458	153.8649	135.2011	131.2057	138.5252	142.3248	162.7751	177.9685	202.4066	(45)
Energy content (annual)										Total = Sum(45)m =			1981.3437
Distribution loss (46)m = 0.15 x (45)m													
	30.7781	27.0566	28.4192	24.3069	23.0797	20.2802	19.6809	20.7788	21.3487	24.4163	26.6953	30.3610	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2400 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2096 (55)
Total storage loss													
	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976	(56)
If cylinder contains dedicated solar storage													
	37.4976	33.8688	37.4976	36.2880	37.4976	36.2880	37.4976	37.4976	36.2880	37.4976	36.2880	37.4976	(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													
	265.9472	235.2575	248.8255	214.0922	201.8306	181.3943	178.9387	187.1888	195.7219	222.1394	236.7685	263.1666	(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													756.0873 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													756.0873
Solar input	-7.2093	-25.4373	-70.8781	-95.4946	-113.1179	-113.9550	-102.9170	-99.0270	-74.3623	-42.6995	-10.9893	-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													
	258.7379	209.8201	177.9475	118.5977	88.7127	67.4393	76.0218	88.1617	121.3596	179.4399	225.7792	263.1666	(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													
	116.8328	103.8795	110.4873	95.5174	89.5326	81.9090	81.8123	84.9905	90.0407	101.6141	106.2145	115.9082	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284	176.4284 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.8209	62.0143	50.4334	38.1813	28.5410	24.0955	26.0360	33.8426	45.4235	57.6756	67.3159	71.7614 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	485.0604	490.0938	477.4098	450.4070	416.3208	384.2846	362.8825	357.8491	370.5331	397.5359	431.6221	463.6583 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833	55.5833 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189	-117.6189 (71)
Water heating gains (Table 5)	157.0333	154.5826	148.5044	132.6630	120.3395	113.7625	109.9628	114.2345	125.0565	136.5781	147.5202	155.7906 (72)
Total internal gains	829.3073	824.0835	793.7404	738.6441	682.5941	636.5354	613.2741	620.3190	655.4059	709.1824	763.8510	808.6030 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	7.5600	15.4404	0.7600	0.7000	0.7000	0.7700	43.0354 (75)					
Southeast	0.9500	46.8814	0.7600	0.7000	0.7000	0.7700	16.4199 (77)					
Southwest	13.2000	46.8814	0.7600	0.7000	0.7000	0.7700	228.1496 (79)					
Solar gains	287.6049	433.0949	621.8274	847.0953	941.8353	1044.4360	912.3397	859.7285	731.1445	506.3653	334.4591	235.2965 (83)
Total gains	1116.9122	1257.1784	1415.5678	1585.7394	1624.4294	1680.9713	1525.6138	1480.0475	1386.5504	1215.5477	1098.3101	1043.8995 (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)	0.9649	0.9478	0.9155	0.8516	0.7585	0.5953	0.5123	0.5078	0.6660	0.8528	0.9373	0.9679 (86)
MIT	19.8835	20.0217	20.2186	20.4782	20.6928	20.8488	20.8863	20.8887	20.8200	20.5750	20.2372	19.9044 (87)
Th 2	20.0386	20.0440	20.0440	20.0593	20.0640	20.0772	20.0793	20.0813	20.0730	20.0544	20.0519	20.0440 (88)
util rest of house	0.9574	0.9371	0.8988	0.8241	0.7144	0.5309	0.4325	0.4253	0.5972	0.8158	0.9219	0.9607 (89)
MIT 2	18.7553	18.9313	19.1736	19.4971	19.7472	19.9190	19.9546	19.9588	19.8923	19.6165	19.2098	18.7868 (90)
Living area fraction	18.9002	19.0714	19.3078	19.6231	19.8686	20.0384	20.0743	20.0782	20.0115	19.7396	19.3417	18.9303 (92)
MIT	18.9002	19.0714	19.3078	19.6231	19.8686	20.0384	20.0743	20.0782	20.0115	19.7396	19.3417	18.9303 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9002	19.0714	19.3078	19.6231	19.8686	20.0384	20.0743	20.0782	20.0115	19.7396	19.3417	18.9303 (93)

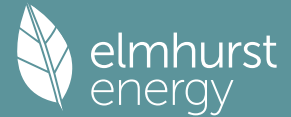
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1056.4742	1161.0008	1250.3601	1283.6281	1143.9959	887.6829	659.1259	629.1050	821.1904	974.1940	996.6025	991.4741 (95)
Ext temp.	6.3000	6.6000	7.5000	9.0000	11.4000	14.0000	15.7000	15.9000	14.3000	11.8000	9.2000	6.8000 (96)
Heat loss rate W	2047.0182	2013.4358	1906.3034	1684.8233	1335.6579	937.6078	677.5536	645.6359	891.3046	1266.4918	1622.5258	1958.3741 (97)
Space heating kWh	736.9648	572.8363	488.0219	288.8605	142.5965	0.0000	0.0000	0.0000	0.0000	217.4696	450.6648	719.3736 (98a)
Space heating requirement - total per year (kWh/year)												3616.7880
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	736.9648	572.8363	488.0219	288.8605	142.5965	0.0000	0.0000	0.0000	0.0000	217.4696	450.6648	719.3736 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3616.7880
Space heating per m2												(98c) / (4) = 23.4643 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from main system(s)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Efficiency of main space heating system 1 (in %)	433.5087	336.9625	287.0717	169.9180	83.8803	0.0000	0.0000	0.0000	0.0000	127.9233	265.0969	423.1610 (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)

Full SAP Calculation Printout



Water heating requirement	258.7379	209.8201	177.9475	118.5977	88.7127	67.4393	76.0218	88.1617	121.3596	179.4399	225.7792	263.1666 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	152.1988	123.4236	104.6750	69.7633	52.1839	39.6702	44.7187	51.8598	71.3880	105.5529	132.8113	154.8039 (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	6.7945	6.7945	6.7945	6.7945	6.7945	6.7945	6.7945	6.7945	6.7945 (231)
Lighting	61.1138	49.0278	44.1441	32.3418	24.9818	20.4103	22.7892	29.6223	38.4764	50.4831	57.0206	62.8123 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.3235	-62.9596	-97.8354	-117.1427	-120.9275	-111.0131	-104.9348	-101.8057	-90.0478	-74.7107	-50.5089	-37.8812 (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	-12.4060	-23.5043	-53.0848	-94.8321	-127.9991	-157.1054	-136.7960	-123.2233	-87.0144	-41.5334	-17.1648	-9.0346 (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												2127.5224 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1103.0495 (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)												493.2234 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1899.7889 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235b)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												1904.0063 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2127.5224	21.5100	457.6301	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1103.0495	21.5100	237.2659	(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	493.2234	21.5100	106.0924	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1016.0908	21.5100	-218.5611	
PV Unit electricity exported	-883.6981	5.5900	-49.3987	
Total			-267.9599	(252)
Total energy cost			550.2365	(255)

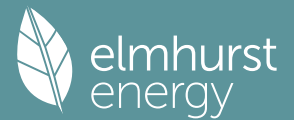
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2127.5224	0.1552	330.2708	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1103.0495	0.1462	161.3205	(264)
Space and water heating			491.5913	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	493.2234	0.1443	71.1874	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1016.0908	0.1345	-136.6264	
PV Unit electricity exported	-883.6981	0.1221	-107.8904	
Total			-244.5169	(269)
Total CO2, kg/year			329.3587	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2127.5224	1.5747	3350.2630	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1103.0495	1.5410	1699.8163	(278)
Space and water heating			5050.0793	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	493.2234	1.5338	756.5225	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1016.0908	1.4969	-1521.0361	
PV Unit electricity exported	-883.6981	0.4479	-395.8335	
Total			-1916.8696	(283)
Total Primary energy kWh/year			4010.7562	(286)

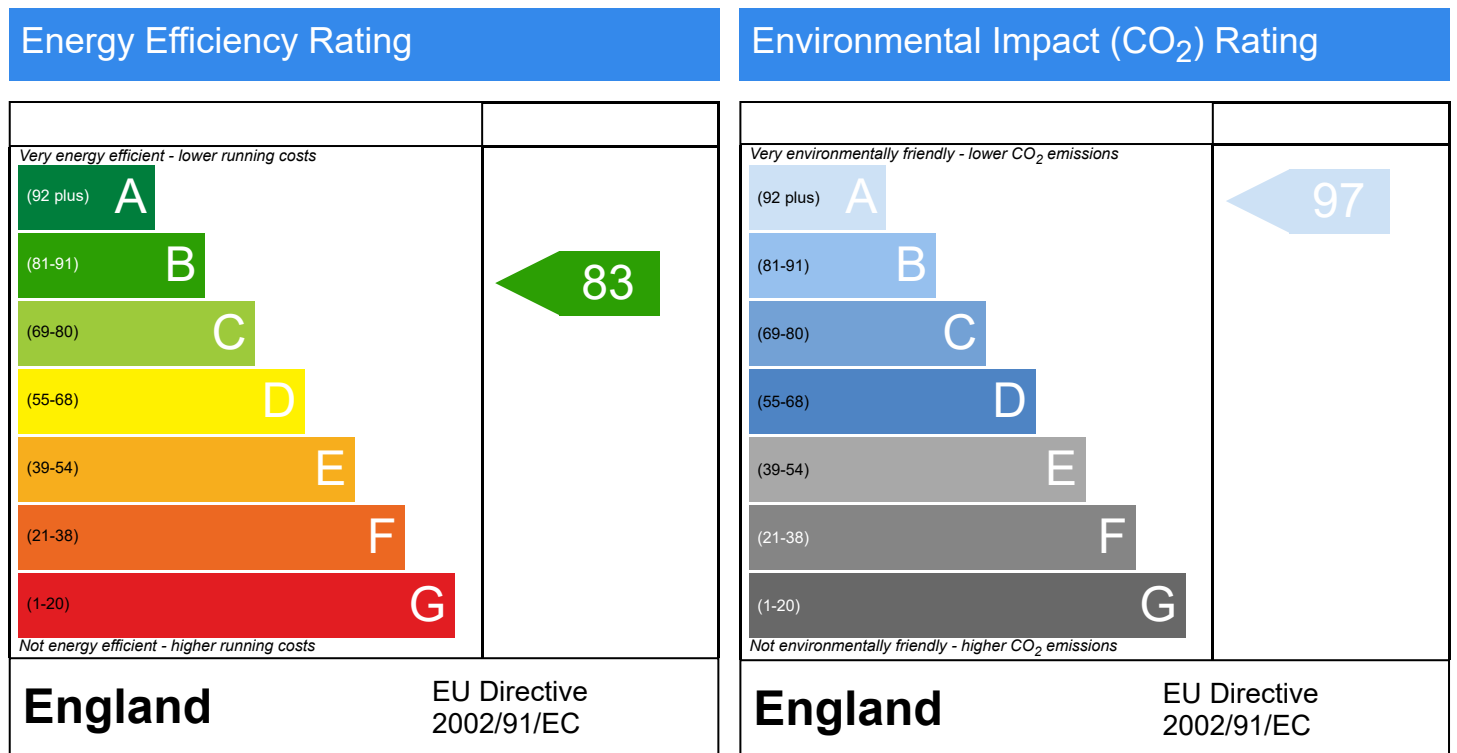
Predicted Energy Assessment



Plot 1, Westwynds, Loscombe Road, Redruth, TR16 6LP Dwelling type: House, Semi-Detached
 Date of assessment: 21/12/2023
 Produced by: Steven Leahy
 Total floor area: 154.14 m²
 DRRN:

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

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



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Thermal Bridging



Property Reference	Westwynds Plot 01		Issued on Date	21/12/2023
Assessment Reference	Plot 01	Prop Type Ref	Semi-Detached House	
Property	Plot 1, Westwynds, Loscombe Road, Redruth, TR16 6LP			

SAP Rating	83 B	DER	3.36	TER	8.62
Environmental	97 A	% DER < TER			61.02
CO ₂ Emissions (t/year)	0.38	DFEE	34.46	TFEE	35.71
Compliance Check	See BREL	% DFEE < TFEE			3.50
% DPER < TPER	15.77	DPER	37.93	TPER	45.03

Assessor Details	Mr. Steven Leahy	Assessor ID	A593-0001
Client	0770, Propcert		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.020	19.10	0.38	BRE 600404
External wall	E3 Sill	Independently assessed	0.029	16.70	0.48	BRE 600406
External wall	E4 Jamb	Independently assessed	0.016	35.70	0.57	BRE 600409
External wall	E5 Ground floor (normal)	Independently assessed	0.067	27.15	1.82	BRE 600384
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.004	27.10	0.11	BRE 600413
External wall	E16 Corner (normal)	Independently assessed	0.048	10.10	0.48	BRE 600421
External wall	E18 Party wall between dwellings	Independently assessed	0.094	10.10	0.95	BRE 600423
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.075	2.40	-0.18	BRE 600422
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.320	9.30	2.98	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.30	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.480	9.30	4.46	
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.040	27.10	1.08	BRE 600417

Total: W/mK:
 Y-Value: W/m²K:

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 21 Dec 2023 07:33:44

Project Information			
Assessed By	Steven Leahy	Building Type	House, Semi-detached
OCDEA Registration	EES/004184	Assessment Date	2023-12-21

Dwelling Details			
Assessment Type	As designed	Total Floor Area	154 m ²
Site Reference	Westwynds Plot 02	Plot Reference	Plot 02
Address	Westwynds Plot 2 Loscombe Road, Redruth, TR16 6LP		

Client Details	
Name	Propcert
Company	Propcert
Address	1821 High Street, Beckenham, BR3 1EW

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	8.67 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	3.38 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	45.29 kWh _{PE} /m ²	
Dwelling primary energy	38.16 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	35.9 kWh/m ²	
Dwelling fabric energy efficiency	34.7 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	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.13	Ground Floor (0.13)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	NE Windows (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)	93.665	0.18
Sheltered wall: Walls (2)	16.56	0.16
Party wall: Party Wall (1)	46.96	0 (!)
Ground floor: Ground Floor, Ground Floor	71.37	0.13
Upper floor: Above Garage, Above Garage	9.12	0.12
Exposed roof: Roof (1)	82.77	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]
Entrance Door, Entrance Door	3.15	North East	N/A	1 (!)
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	2.16	North East	0.7	1.2
NE Windows, Windows	1.08	North East	0.7	1.2
Plot 2 NW Door, Entrance Door	1.89	North West	N/A	1 (!)
Plot 2 NW Window, Windows	0.945	North West	0.7	1.2
SW Windows, Windows	0.945	South West	0.7	1.2
SW Windows, Windows	0.945	South West	0.7	1.2
SW Windows, Windows	2.16	South West	0.7	1.2
SW Windows, Windows	2.16	South West	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
SW Windows, Windows	2.16	South West	0.7	1.2
SW Windows, Windows	4.83	South West	0.7	1.2

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	0.02 (!)	BRE 600404
External wall	E3: Sill	Calculated by person with suitable expertise	0.029 (!)	BRE 600406
External wall	E4: Jamb	Calculated by person with suitable expertise	0.016 (!)	BRE 600409
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.067	BRE 600384
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.004 (!)	BRE 600413
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.048	BRE 600421
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.094	BRE 600423
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.075	BRE 600422
Party wall	P1: Ground floor	SAP table default	0.32	
Party wall	P2: Intermediate floor within a dwelling	SAP table default	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	SAP table default	0.48	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.04	BRE 600417

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	170.0%
Emitter type	Both radiator and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

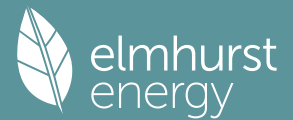
Capacity	200 litres
Declared heat loss	2.24 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		
7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	40 lm/W	FAIL
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2 kWp	
Orientation	South West	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

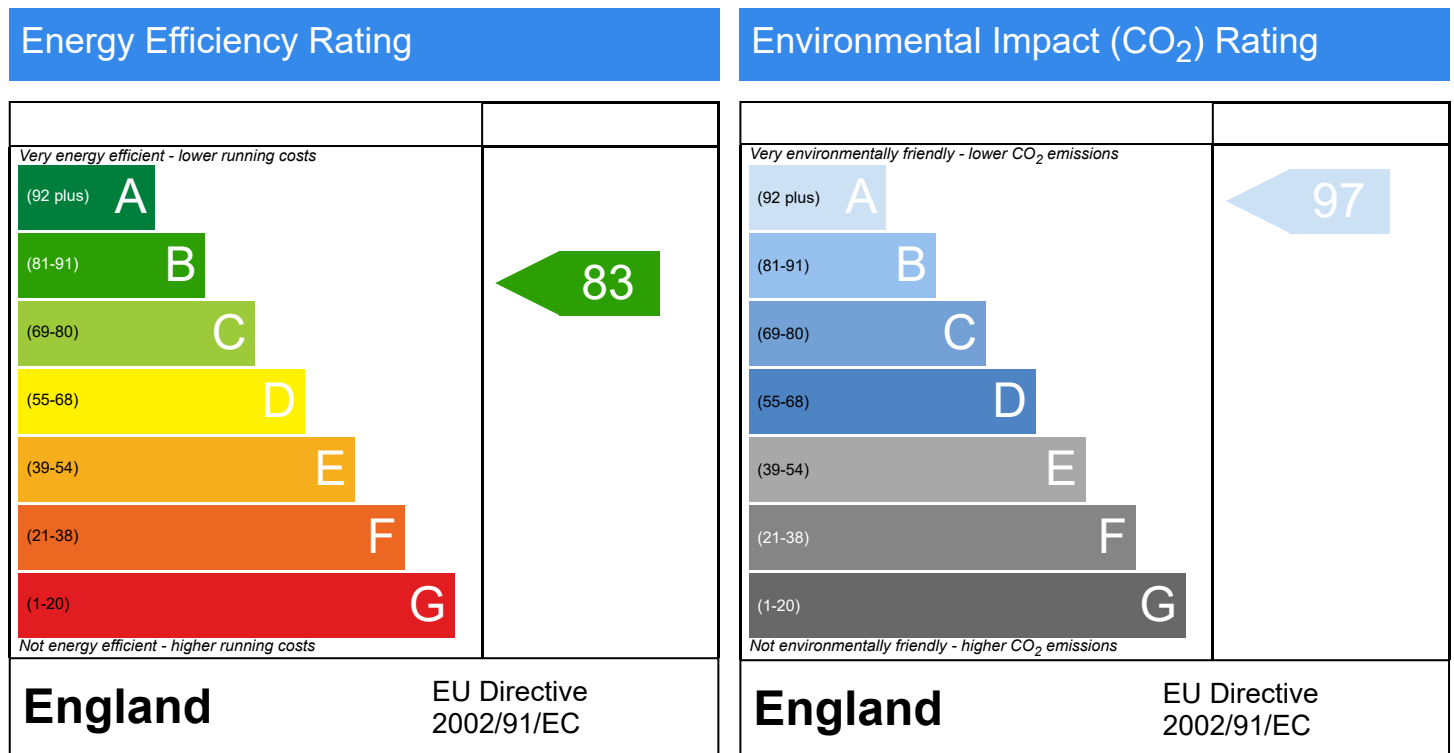
Predicted Energy Assessment



Plot 2, Westwynds, Loscombe Road, Redruth, TR16 6LP Dwelling type: House, Semi-Detached
 Date of assessment: 21/12/2023
 Produced by: Steven Leahy
 Total floor area: 154.14 m²
 DRRN:

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

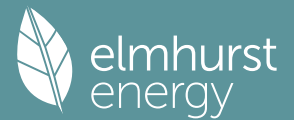
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Thermal Bridging



Property Reference	Westwynds Plot 02		Issued on Date	21/12/2023
Assessment Reference	Plot 02	Prop Type Ref	Semi-Detached House	
Property	Plot 2, Westwynds, Loscombe Road, Redruth, TR16 6LP			

SAP Rating	83 B	DER	3.38	TER	8.67
Environmental	97 A	% DER < TER			61.01
CO ₂ Emissions (t/year)	0.38	DFEE	34.71	TFEE	35.93
Compliance Check	See BREL	% DFEE < TFEE			3.40
% DPER < TPER	15.73	DPER	38.16	TPER	45.29

Assessor Details	Mr. Steven Leahy	Assessor ID	A593-0001
Client	0770, Propcert		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.020	19.10	0.38	BRE 600404
External wall	E3 Sill	Independently assessed	0.029	16.70	0.48	BRE 600406
External wall	E4 Jamb	Independently assessed	0.016	35.70	0.57	BRE 600409
External wall	E5 Ground floor (normal)	Independently assessed	0.067	27.15	1.82	BRE 600384
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.004	27.10	0.11	BRE 600413
External wall	E16 Corner (normal)	Independently assessed	0.048	10.10	0.48	BRE 600421
External wall	E18 Party wall between dwellings	Independently assessed	0.094	10.10	0.95	BRE 600423
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.075	2.40	-0.18	BRE 600422
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.320	9.30	2.98	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.30	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.480	9.30	4.46	
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.040	27.10	1.08	BRE 600417

Total: W/mK:
 Y-Value: W/m²K: