

Building Regulations England Part L (BREL) Compliance Report

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

Date: Thu 27 Jul 2023 11:55:53

Project Information			
Assessed By	[REDACTED]	Building Type	Bungalow, Detached
OCDEA Registration	[REDACTED]	Assessment Date	2023-07-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	135 m ²
Site Reference	New Build	Plot Reference	00001
Address	[REDACTED]		

Client Details	
Name	[REDACTED]
Company	[REDACTED]
Address	[REDACTED]

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	8.41 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	-2.5 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	46.33 kWh _{PE} /m ²		
Dwelling primary energy	25.54 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	48.3 kWh/m ²		
Dwelling fabric energy efficiency	41.9 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	0.14	Walls (1) (0.14)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.09	Heatloss Floor 1 (0.09)	OK
Roofs	0.16	0.15	Roof (1) (0.15)	OK
Windows, doors, and roof windows	1.6	0.91	Rooflights (1.3)	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)	115.38	0.14 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	135	0.09 (!)
Exposed roof: Roof (1)	155.35	0.15

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Opening, Opening Type 1	1.92	North	0.7	0.8 (!)
Opening, Opening Type 1	4.86	West	0.7	0.8 (!)
Opening, Opening Type 1	9.24	South	0.7	0.8 (!)
Opening, Opening Type 1	6.3	East	0.7	0.8 (!)
Rooflights, Rooflights	6.65	North	0.7	1.3

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	0.014 (!)	BE-E2-23911
External wall	E3: Sill	Calculated by person with suitable expertise	0.046	BE-E3-23912

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.005 (!)	BE-E4-23913
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.064	BE-E5-23914
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.054	XT-CWP-E11-RF-03
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.075	XT-CWP-E13-RG-03
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.042	BE-E16-23919
Roof	R1: Head of roof window	SAP table default	0.24	
Roof	R2: Sill of roof window	SAP table default	0.24	
Roof	R3: Jamb of roof window	SAP table default	0.24	

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	2.3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Electricity

Efficiency	100.0%
Emitter type	Underfloor
Flow temperature	
System type	Electric water storage boiler
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A

Fuel	Wood logs
Efficiency	77.2%
Commissioning	

5 Hot water

Cylinder/store - type: N/A

Capacity	350 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	N/A
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

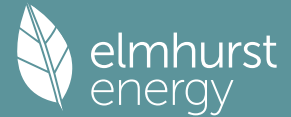
Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	250 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.46 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	92%	OK
Manufacturer/Model	Sentinel Kinetic Advance S, 405215	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	11.7 kWp	
Orientation	South	
Pitch	30°	
Overshading	1 (overshading factor calculated according to MCS)	
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		

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External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000	(29a)
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500	(30)
Total net area of external elements Aum(A, m2)			434.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.1257			(33)
Internal Wall 1			146.0000			9.0000	1314.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17562.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 130.0900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.8200	0.0140	0.2215
E3 Sill	15.8200	0.0460	0.7277
E4 Jamb	32.1000	0.0050	0.1605
E5 Ground floor (normal)	51.0000	0.0640	3.2640
E11 Eaves (insulation at rafter level)	36.0000	0.0540	1.9440
E13 Gable (insulation at rafter level)	18.0000	0.0750	1.3500
E16 Corner (normal)	10.4000	0.0420	0.4368
R1 Head of roof window	15.0000	0.2400	3.6000
R2 Sill of roof window	15.0000	0.2400	3.6000
R3 Jamb of roof window	20.0000	0.2400	4.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.1045 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 97.2302 (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	42.7075	42.0730	41.4384	38.2656	37.6310	34.4581	34.4581	33.8236	35.7273	37.6310	38.9001	40.1693
Average = Sum(39)m / 12 =	139.9378	139.3032	138.6686	135.4958	134.8612	131.6884	131.6884	131.0538	132.9575	134.8612	136.1303	137.3995
												135.3371

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0366	1.0319	1.0272	1.0037	0.9990	0.9755	0.9755	0.9708	0.9849	0.9990	1.0084	1.0178
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

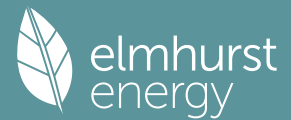
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9069	(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	84.1621	82.9122	81.1520	77.9066	75.4765	72.7819	71.3264	73.0742	74.9773	77.8606	81.1729	83.8776	83.8776	(42b)
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995	44.3995	(42c)
Average daily hot water use (litres/day)													118.3947	(43)
Daily hot water use	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771	128.2771	(44)
Energy conte	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509	200.8509	(45)
Energy content (annual)													1966.1152	
Distribution loss (46)m = 0.15 x (45)m	30.5415	26.8487	28.2008	24.1201	22.9023	20.1243	19.5296	20.6191	21.1846	24.2286	26.4901	30.1276	30.1276	(46)
Water storage loss:														
Store volume													350.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	(56)
If cylinder contains dedicated solar storage														
Primary loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	236.0049	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Total per year (kWh/year)	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	2380.0252	(64)
Electric shower(s)													2380	(64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
	67.7004	59.5145	62.5117	53.4661	50.7669	44.6088	43.2906	45.7056	46.9593	53.7067	58.7197	66.7829	66.7829	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9366	170.4298	153.9366	159.0678	153.9366	159.0678	153.9366	153.9366	159.0678	153.9366	159.0678	153.9366

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	90.9951	88.5633	84.0211	74.2585	68.2350	61.9567	58.1863	61.4323	65.2212	72.1865	81.5552	89.7620 (72)
Total internal gains	618.1865	635.3988	606.4231	584.8878	552.3949	528.1929	505.8933	505.9884	522.8488	544.5868	580.4249	603.5554 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	1.9200	10.6334	0.5700	0.7000	0.7000	0.7700	5.6452 (74)
East	6.3000	19.6403	0.5700	0.7000	0.7000	0.7700	34.2132 (76)
South	9.2400	46.7521	0.5700	0.7000	0.7000	0.7700	119.4480 (78)
West	4.8600	19.6403	0.5700	0.7000	0.7000	0.7700	26.3931 (80)
North	6.6500	26.0000	0.6300	0.7000	1.0000	1.0000	68.6240 (82)

Solar gains	254.3235	467.4988	716.1538	991.7537	1188.8985	1210.0287	1154.5648	1005.9870	812.9633	538.7213	311.2193	213.1869 (83)
Total gains	872.5100	1102.8976	1322.5769	1576.6414	1741.2933	1738.2216	1660.4582	1511.9754	1335.8121	1083.3082	891.6442	816.7424 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.8610	35.0198	35.1801	36.0039	36.1733	37.0448	37.0448	37.2242	36.6912	36.1733	35.8361	35.5050
alpha	3.3241	3.3347	3.3453	3.4003	3.4116	3.4697	3.4697	3.4816	3.4461	3.4116	3.3891	3.3670
util living area	0.9760	0.9500	0.8994	0.7876	0.6343	0.4638	0.3430	0.3888	0.6142	0.8613	0.9571	0.9802 (86)
MIT	19.4335	19.7202	20.0909	20.5108	20.7594	20.8742	20.9013	20.8964	20.8129	20.4385	19.8695	19.4039 (87)
Th 2	20.0530	20.0569	20.0607	20.0803	20.0842	20.1038	20.1038	20.1078	20.0960	20.0842	20.0764	20.0685 (88)
util rest of house	0.9717	0.9417	0.8833	0.7571	0.5880	0.4050	0.2755	0.3172	0.5516	0.8328	0.9486	0.9768 (89)
MIT 2	18.2069	18.5705	19.0333	19.5509	19.8309	19.9630	19.9848	19.9860	19.9032	19.4830	18.7775	18.1807 (90)
Living area fraction									fLA = Living area / (4) =			0.3704 (91)
MIT	18.6612	18.9964	19.4250	19.9064	20.1748	20.3005	20.3242	20.3231	20.2401	19.8369	19.1819	18.6338 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6612	18.9964	19.4250	19.9064	20.1748	20.3005	20.3242	20.3231	20.2401	19.8369	19.1819	18.6338 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9637	0.9302	0.8707	0.7508	0.5928	0.4182	0.2923	0.3348	0.5621	0.8240	0.9383	0.9697 (94)
Ext temp.	840.8205	1025.9686	1151.5025	1183.7222	1032.2606	726.9735	485.3966	506.1437	750.8689	892.6788	836.6392	791.9986 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2009.6675	1963.6675	1792.2877	1491.3245	1142.9194	750.6882	490.4402	514.1432	816.3779	1245.6992	1644.7146	1983.1907 (97)
Space heating requirement - total per year (kWh/year)	869.6222	630.1337	476.7442	221.4736	82.3301	0.0000	0.0000	0.0000	0.0000	262.6472	581.8143	886.2469 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	869.6222	630.1337	476.7442	221.4736	82.3301	0.0000	0.0000	0.0000	0.0000	262.6472	581.8143	886.2469 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.0122
Space heating per m ²										(98c) / (4) =		29.7112 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												77.2000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	869.6222	630.1337	476.7442	221.4736	82.3301	0.0000	0.0000	0.0000	0.0000	262.6472	581.8143	886.2469 (98)
Space heating fuel (main heating system)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)

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Space heating efficiency (main heating system 2)	782.6600	567.1203	429.0698	199.3263	74.0971	0.0000	0.0000	0.0000	0.0000	236.3825	523.6329	797.6222	(211)
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	(212)
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	(213)
Water heating	112.6454	81.6235	61.7544	28.6883	10.6645	0.0000	0.0000	0.0000	0.0000	34.0217	75.3645	114.7988	(215)
Water heating requirement	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	(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	27.8049	25.1141	27.8049	26.9080	27.8049	26.9080	27.8049	27.8049	26.9080	27.8049	26.9080	27.8049	(231)
Lighting	24.4275	19.5967	17.6446	12.9272	9.9854	8.1581	9.1090	11.8402	15.3792	20.1784	22.7915	25.1065	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-174.2878	-228.4624	-288.3214	-251.9845	-205.6030	-153.6469	-151.7845	-152.9225	-153.2190	-209.9842	-179.8803	-152.5682	(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	-118.7183	-260.4804	-544.4042	-864.0320	-1173.1412	-1201.8784	-1185.8269	-1015.7553	-762.0901	-415.0642	-167.6670	-92.6278	(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												3609.9110	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												519.5612	(215)
Efficiency of water heater												100.0000	(216)
Water heating fuel used												2380.0252	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440) mechanical ventilation fans (SFP = 0.6440) central heating pump												286.3804	(230a)
Total electricity for the above, kWh/year												41.0000	(230c)
Electricity for lighting (calculated in Appendix L)												327.3804	(231)
												197.1443	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-10104.3504	(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												-3070.3284	(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 (high-rate cost)	3248.9199	0.1638	532.1212 (261)
Space heating - main system 1 (low-rate cost)	360.9911	0.1375	49.6386 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	519.5612	0.0280	14.5477 (263)
Water heating - high rate cost	0.0000	0.0000	0.0000 (264)
Water heating - low rate cost	2380.0252	0.1242	295.6237 (264)
Space and water heating			891.9312 (265)
Pumps, fans and electric keep-hot	327.3804	0.1432	45.6087 (267)
Energy for lighting	197.1443	0.1490	29.3784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2302.6646	0.1453	-334.4709
PV Unit electricity exported	-7801.6859	0.1244	-970.2155
Total			-1304.6864 (269)
Total CO2, kg/year			-337.7681 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-2.5000 (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 (high-rate cost)	3248.9199	1.4495	5232.4019 (275)
Space heating - main system 1 (low-rate cost)	360.9911	1.4978	540.7051 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	519.5612	1.0460	543.4610 (277)

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Water heating - high rate cost	0.0000	0.0000	0.0000 (278)
Water heating - low rate cost	2380.0252	1.4445	3438.0220 (278)
Space and water heating			9754.5900 (279)
Pumps, fans and electric keep-hot	327.3804	1.5335	496.1536 (281)
Energy for lighting	197.1443	1.5547	306.5091 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2302.6646	1.5411	-3548.5880
PV Unit electricity exported	-7801.6859	0.4564	-3560.9319
Total			-7109.5199 (283)
Total Primary energy kWh/year			3447.7328 (286)
Dwelling Primary energy Rate (DPER)			25.5400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 364.5000 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1097 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3597	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3597 (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	0.4587	0.4497	0.4407	0.3957	0.3867	0.3418	0.3418	0.3328	0.3597	0.3867	0.4047	0.4227 (22b)
Effective ac	0.6052	0.6011	0.5971	0.5783	0.5748	0.5584	0.5584	0.5554	0.5647	0.5748	0.5819	0.5893 (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
TER Opening Type (U _w = 1.20)			22.3200	1.1450	25.5573		(27)
Rooflights			6.6500	1.5918	10.5852		(27a)
Heatloss Floor 1			135.0000	0.1300	17.5500		(28a)
External Wall 1	137.7000	22.3200	115.3800	0.1800	20.7684		(29a)
External Roof 1	162.0000	6.6500	155.3500	0.1100	17.0885		(30)
Total net area of external elements A _{um} (A, m ²)			434.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	91.5494	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 130.0900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.8200	0.0500	0.7910
E3 Sill	15.8200	0.0500	0.7910
E4 Jamb	32.1000	0.0500	1.6050

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E5 Ground floor (normal)	51.0000	0.1600	8.1600
E11 Eaves (insulation at rafter level)	36.0000	0.0400	1.4400
E13 Gable (insulation at rafter level)	18.0000	0.0800	1.4400
E16 Corner (normal)	10.4000	0.0900	0.9360
R1 Head of roof window	15.0000	0.0800	1.2000
R2 Sill of roof window	15.0000	0.0600	0.9000
R3 Jamb of roof window	20.0000	0.0800	1.6000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.8630 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	110.4124 (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	72.7950	72.3037	71.8221	69.5602	69.1369	67.1668	67.1668	66.8020	67.9257	69.1369	69.9931	70.8882 (38)
Average = Sum(39)m / 12 =	183.2074	182.7161	182.2345	179.9725	179.5493	177.5792	177.5792	177.2143	178.3380	179.5493	180.4055	181.3005 (39)
												179.9705

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3571	1.3535	1.3499	1.3331	1.3300	1.3154	1.3154	1.3127	1.3210	1.3300	1.3363	1.3430 (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													2.9069 (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	84.1621	82.9122	81.1520	77.9066	75.4765	72.7819	71.3264	73.0742	74.9773	77.8606	81.1729	83.8776	83.8776 (42b)
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995	44.3995 (42c)
Average daily hot water use (litres/day)													118.3947 (43)
Daily hot water use	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771	128.2771 (44)
Energy content (annual)	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509	200.8509 (45)
Distribution loss (46)m = 0.15 x (45)m	30.5415	26.8487	28.2008	24.1201	22.9023	20.1243	19.5296	20.6191	21.1846	24.2286	26.4901	30.1276	30.1276 (46)
Water storage loss:													350.0000 (47)
Store volume													2.3230 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.2544 (55)
Enter (49) or (54) in (55)													
Total storage loss	38.8862	35.1230	38.8862	37.6318	38.8862	37.6318	38.8862	38.8862	37.6318	38.8862	37.6318	38.8862	38.8862 (56)
If cylinder contains dedicated solar storage	38.8862	35.1230	38.8862	37.6318	38.8862	37.6318	38.8862	38.8862	37.6318	38.8862	37.6318	38.8862	38.8862 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	265.7588	235.1253	250.1537	220.9442	214.8309	194.3057	192.3459	199.6091	201.3747	223.6727	236.7445	262.9996	262.9996 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	265.7588	235.1253	250.1537	220.9442	214.8309	194.3057	192.3459	199.6091	201.3747	223.6727	236.7445	262.9996	262.9996 (64)
Total per year (kWh/year)													2697.8652 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	117.4193	104.4219	112.2306	101.5812	100.4858	92.7239	93.0095	95.4245	95.0743	103.4256	106.8348	116.5018	116.5018 (65)

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

Metabolic gains (Table 5), Watts													
(66)m	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1382	169.5459	153.1382	158.2428	153.1382	158.2428	153.1382	153.1382	158.2428	153.1382	158.2428	153.1382	153.1382 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	157.8216	155.3898	150.8476	141.0850	135.0615	128.7832	125.0128	128.2588	132.0477	139.0130	148.3817	156.5885	156.5885 (72)
Total internal gains	684.2146	701.3414	672.4512	650.8893	618.4230	594.1944	571.9214	572.0165	588.8503	610.6149	646.4264	669.5835	669.5835 (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				
North		1.9200	10.6334	0.6300	0.7000	0.7700	6.2394 (74)					
East		6.3000	19.6403	0.6300	0.7000	0.7700	37.8146 (76)					
South		9.2400	46.7521	0.6300	0.7000	0.7700	132.0215 (78)					
West		4.8600	19.6403	0.6300	0.7000	0.7700	29.1713 (80)					
North		6.6500	26.0000	0.6300	0.7000	1.0000	68.6240 (82)					
Solar gains	273.8708	501.7064	764.8668	1054.4743	1260.7023	1281.8342	1223.5881	1068.2611	866.5879	577.0921	334.8109	229.7932 (83)
Total gains	958.0854	1203.0478	1437.3180	1705.3635	1879.1253	1876.0285	1795.5095	1640.2775	1455.4383	1187.7070	981.2373	899.3768 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.6276	26.6992	26.7698	27.1062	27.1701	27.4715	27.4715	27.5281	27.3547	27.1701	27.0412	26.9077
alpha	2.7752	2.7799	2.7847	2.8071	2.8113	2.8314	2.8314	2.8352	2.8236	2.8113	2.8027	2.7938
util living area	0.9723	0.9490	0.9070	0.8197	0.6927	0.5381	0.4109	0.4600	0.6738	0.8759	0.9548	0.9764 (86)
MIT	18.4341	18.8275	19.3826	20.0536	20.5527	20.8451	20.9468	20.9260	20.6956	19.9953	19.0952	18.3761 (87)
Th 2	19.7964	19.7992	19.8020	19.8150	19.8174	19.8288	19.8288	19.8309	19.8244	19.8174	19.8125	19.8073 (88)
util rest of house	0.9669	0.9396	0.8898	0.7870	0.6383	0.4583	0.3106	0.3564	0.5978	0.8452	0.9448	0.9719 (89)
MIT 2	16.8371	17.3336	18.0266	18.8458	19.4151	19.7213	19.8044	19.7941	19.5887	18.8023	17.6863	16.7698 (90)
Living area fraction										fLA = Living area / (4) =		0.3704 (91)
MIT	17.4286	17.8869	18.5288	19.2931	19.8364	20.1375	20.2275	20.2133	19.9986	19.2442	18.2081	17.3647 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4286	17.8869	18.5288	19.2931	19.8364	20.1375	20.2275	20.2133	19.9986	19.2442	18.2081	17.3647 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9517	0.9192	0.8667	0.7704	0.6392	0.4804	0.3459	0.3917	0.6101	0.8269	0.9261	0.9582 (94)
Useful gains	911.8443	1105.8353	1245.7592	1313.7928	1201.1994	901.3072	621.0371	642.5089	887.9602	982.1489	908.7596	861.7780 (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	2405.2529	2372.9153	2192.0677	1870.4765	1460.8914	983.3506	644.1642	675.7779	1051.9533	1552.0525	2003.9630	2386.7734 (97)
Space heating kWh	1111.0960	851.4777	704.0535	400.8122	193.2108	0.0000	0.0000	0.0000	0.0000	424.0083	788.5464	1134.5965 (98a)
Space heating requirement - total per year (kWh/year)												5607.8016
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	1111.0960	851.4777	704.0535	400.8122	193.2108	0.0000	0.0000	0.0000	0.0000	424.0083	788.5464	1134.5965 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5607.8016
Space heating per m2												(98c) / (4) = 41.5393 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

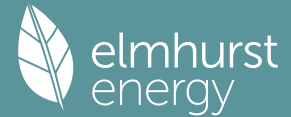
Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1111.0960	851.4777	704.0535	400.8122	193.2108	0.0000	0.0000	0.0000	0.0000	424.0083	788.5464	1134.5965 (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)	1203.7877	922.5111	762.7882	434.2494	209.3292	0.0000	0.0000	0.0000	0.0000	459.3806	854.3298	1229.2487 (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	265.7588	235.1253	250.1537	220.9442	214.8309	194.3057	192.3459	199.6091	201.3747	223.6727	236.7445	262.9996 (64)
Efficiency of water heater (217)m	86.9081	86.6845	86.2499	85.3782	83.8227	79.8000	79.8000	79.8000	79.8000	85.4710	86.5462	79.8000 (216)
												86.9545 (217)

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Fuel for water heating, kWh/month	305.7929	271.2426	290.0337	258.7828	256.2920	243.4909	241.0349	250.1368	252.3493	261.6942	273.5471	302.4564	(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	31.8191	25.5265	22.9837	16.8389	13.0068	10.6267	11.8653	15.4229	20.0329	26.2842	29.6879	32.7034	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-96.1018	-122.6307	-159.7031	-162.1053	-161.2955	-145.8360	-143.7874	-141.8283	-137.2522	-130.8625	-100.8361	-84.6586	(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	-101.5648	-205.5604	-394.6596	-573.9187	-741.7660	-739.4038	-730.8625	-626.5621	-469.7868	-287.4588	-133.3020	-80.9702	(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													6075.6247 (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													3206.8535 (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)													256.7983 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-6672.7132 (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													2952.5633 (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	6075.6247	0.2100	1275.8812 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3206.8535	0.2100	673.4392 (264)
Space and water heating			1949.3204 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	256.7983	0.1443	37.0639 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1586.8976	0.1368	-217.1053
PV Unit electricity exported	-5085.8156	0.1269	-645.2374
Total			-862.3427 (269)
Total CO2, kg/year			1135.9709 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.4100 (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	6075.6247	1.1300	6865.4559 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3206.8535	1.1300	3623.7445 (278)
Space and water heating			10489.2004 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	256.7983	1.5338	393.8858 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1586.8976	1.5058	-2389.4720
PV Unit electricity exported	-5085.8156	0.4657	-2368.6772
Total			-4758.1492 (283)
Total Primary energy kWh/year			6255.0378 (286)
Target Primary Energy Rate (TPER)			46.3300 (287)

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1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	135.0000 (1b)		2.7000 (2b)		364.5000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 364.5000 (5)

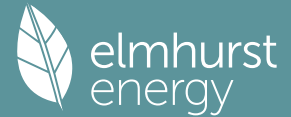
2. Ventilation rate

		m ³ per hour											
Number of open chimneys		0 * 80 =	0.0000 (6a)										
Number of open flues		0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)										
Number of blocked chimneys		0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans		4 * 10 =	40.0000 (7a)										
Number of passive vents		0 * 10 =	0.0000 (7b)										
Number of flueless gas fires		0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.1097 (8)										
Pressure test			Yes										
Pressure Test Method			Blower Door										
Measured/design AP50			2.3000 (17)										
Infiltration rate			0.2247 (18)										
Number of sides sheltered			0 (19)										
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)										
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2247 (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	0.2865	0.2809	0.2753	0.2472	0.2416	0.2135	0.2135	0.2079	0.2247	0.2416	0.2528	0.2641	(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	0.5411	0.5395	0.5379	0.5306	0.5292	0.5228	0.5228	0.5216	0.5253	0.5292	0.5320	0.5349	(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						
Opening Type 1 (Uw = 0.80)			22.3200	0.7752	17.3023			(27)					
Rooflights			6.6500	1.2357	8.2177			(27a)					
Heatloss Floor 1			135.0000	0.0900	12.1500	110.0000	14850.0000	(28a)					
External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000	(29a)					
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500	(30)					
Total net area of external elements Aum(A, m ²)			434.7000					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	77.1257		(33)					
Internal Wall 1			146.0000			9.0000	1314.0000	(32c)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	17562.1500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								130.0900 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				15.8200	0.0140		0.2215						
E3 Sill				15.8200	0.0460		0.7277						
E4 Jamb				32.1000	0.0050		0.1605						
E5 Ground floor (normal)				51.0000	0.0640		3.2640						
E11 Eaves (insulation at rafter level)				36.0000	0.0540		1.9440						
E13 Gable (insulation at rafter level)				18.0000	0.0750		1.3500						
E16 Corner (normal)				10.4000	0.0420		0.4368						
R1 Head of roof window				15.0000	0.2400		3.6000						
R2 Sill of roof window				15.0000	0.2400		3.6000						
R3 Jamb of roof window				20.0000	0.2400		4.8000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.1045	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	97.2302 (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	65.0806	64.8889	64.7009	63.8181	63.6529	62.8840	62.8840	62.7416	63.1802	63.6529	63.9870	64.3364	(38)
Average = Sum(39)m / 12 =	162.3108	162.1191	161.9311	161.0483	160.8831	160.1142	160.1142	159.9718	160.4104	160.8831	161.2173	161.5666	(39)
													161.0475

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	Jan 1.2023	Feb 1.2009	Mar 1.1995	Apr 1.1930	May 1.1917	Jun 1.1860	Jul 1.1860	Aug 1.1850	Sep 1.1882	Oct 1.1917	Nov 1.1942	Dec 1.1968 (40) 1.1929
HLP												
HLP (average)												
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9069 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	31.4979	31.0301	30.3714	29.1568	28.2473	27.2388	26.6941	27.3482	28.0605	29.1396	30.3792	31.3914 (42b)
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995 (42c)
Average daily hot water use (litres/day)												69.5667 (43)
Daily hot water use	75.8974	73.8151	71.5418	68.7127	66.1887	63.5657	63.0210	65.2896	67.6164	70.3100	73.1642	75.7909 (44)
Energy content (annual)	120.2029	105.1117	109.9571	94.0642	89.1027	78.1614	76.2184	80.8422	83.3778	95.4100	104.2358	118.6703 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	102.1725	89.3450	93.4636	79.9546	75.7373	66.4372	64.7856	68.7159	70.8711	81.0985	88.6004	100.8697 (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	102.1725	89.3450	93.4636	79.9546	75.7373	66.4372	64.7856	68.7159	70.8711	81.0985	88.6004	100.8697 (64)
12Total per year (kWh/year)												982.0514 (64)
Electric shower(s)	58.4279	52.0597	56.8472	54.2486	55.2666	52.7190	54.4763	55.2666	54.2486	56.8472	55.7783	58.4279 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												664.6139 (64a)
Heat gains from water heating, kWh/month	40.1501	35.3512	37.5777	33.5508	32.7510	29.7890	29.8155	30.9956	31.2799	34.4864	36.0947	39.8244 (65)

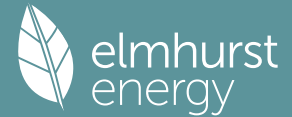
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.9366	170.4298	153.9366	159.0678	153.9366	159.0678	153.9366	153.9366	159.0678	153.9366	159.0678	153.9366 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	53.9652	52.6059	50.5077	46.5983	44.0201	41.3737	40.0746	41.6608	43.4443	46.3527	50.1315	53.5274 (72)
Total internal gains	578.1565	596.4414	569.9097	554.2276	525.1800	507.6098	487.7816	486.2169	501.0720	515.7531	546.0012	564.3209 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.9200	10.6334	0.5700	0.7000	0.7700	5.6452 (74)						
East	6.3000	19.6403	0.5700	0.7000	0.7700	34.2132 (76)						
South	9.2400	46.7521	0.5700	0.7000	0.7700	119.4480 (78)						
West	4.8600	19.6403	0.5700	0.7000	0.7700	26.3931 (80)						
North	6.6500	26.0000	0.6300	0.7000	1.0000	68.6240 (82)						
Solar gains	254.3235	467.4988	716.1538	991.7537	1188.8985	1210.0287	1154.5648	1005.9870	812.9633	538.7213	311.2193	213.1869 (83)
Total gains	832.4800	1063.9403	1286.0635	1545.9813	1714.0784	1717.6386	1642.3464	1492.2039	1314.0353	1054.4744	857.2206	777.5078 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, n_{l,m} (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.0558	30.0913	30.1262	30.2914	30.3225	30.4681	30.4681	30.4952	30.4118	30.3225	30.2596	30.1942
alpha	3.0037	3.0061	3.0084	3.0194	3.0215	3.0312	3.0312	3.0330	3.0275	3.0215	3.0173	3.0129
util living area	0.9798	0.9590	0.9188	0.8304	0.6982	0.5391	0.4095	0.4621	0.6840	0.8914	0.9653	0.9834 (86)
MIT	18.6130	18.9965	19.5295	20.1601	20.6216	20.8751	20.9595	20.9413	20.7369	20.0735	19.2153	18.5400 (87)
Th 2	19.9182	19.9193	19.9204	19.9256	19.9266	19.9312	19.9312	19.9320	19.9294	19.9266	19.9246	19.9226 (88)
util rest of house	0.9760	0.9515	0.9041	0.8006	0.6476	0.4650	0.3174	0.3660	0.6134	0.8649	0.9577	0.9802 (89)
MIT 2	17.7484	18.1266	18.6464	19.2461	19.6568	19.8618	19.9160	19.9082	19.7662	19.1831	18.3506	17.6791 (90)
Living area fraction									fLA = Living area / (4) =			0.3704 (91)
MIT	18.0686	18.4487	18.9735	19.5846	20.0141	20.2371	20.3025	20.2908	20.1257	19.5129	18.6709	17.9980 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0686	18.4487	18.9735	19.5846	20.0141	20.2371	20.3025	20.2908	20.1257	19.5129	18.6709	17.9980 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9671	0.9383	0.8883	0.7899	0.6520	0.4872	0.3503	0.3995	0.6274	0.8527	0.9459	0.9723 (94)
Useful gains	805.0511	998.2708	1142.4000	1221.1330	1117.5702	836.7502	575.2693	596.0664	824.4500	899.1005	810.8220	756.0040 (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	2234.7941	2196.5101	2019.8480	1720.7425	1337.6025	902.5786	592.8165	622.4214	966.5832	1433.9294	1865.4217	2229.2918 (97)
Space heating kWh	1063.7288	805.2168	652.8213	359.7188	163.7041	0.0000	0.0000	0.0000	0.0000	397.9127	759.3118	1096.1262 (98a)
Space heating requirement - total per year (kWh/year)												5298.5405
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	1063.7288	805.2168	652.8213	359.7188	163.7041	0.0000	0.0000	0.0000	0.0000	397.9127	759.3118	1096.1262 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5298.5405
Space heating per m ²										(98c) / (4) =		39.2484 (99)

8c. Space cooling requirement

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

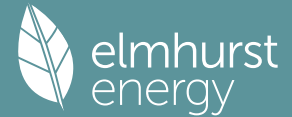
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1505.0735	1184.8451	1215.7857	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8238	0.8782	0.8466	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1239.8875	1040.5103	1029.3367	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1852.5780	1772.4406	1614.2847	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	441.1372	544.5561	435.2013	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	110.2843	136.1390	108.8003	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												355.2236 (107)
Energy for space heating												39.2484 (99)
Energy for space cooling												2.6313 (108)
Total												41.8797 (109)
Fabric Energy Efficiency (DFEE)												41.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	364.5000 (5)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.8974	73.8151	71.5418	68.7127	66.1887	63.5657	63.0210	65.2896	67.6164	70.3100	73.1642	75.7909 (44)
Energy content	120.2029	105.1117	109.9571	94.0642	89.1027	78.1614	76.2184	80.8422	83.3778	95.4100	104.2358	118.6703 (45)
Energy content (annual)												Total = Sum(45)m = 1155.3545
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	102.1725	89.3450	93.4636	79.9546	75.7373	66.4372	64.7856	68.7159	70.8711	81.0985	88.6004	100.8697 (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	102.1725	89.3450	93.4636	79.9546	75.7373	66.4372	64.7856	68.7159	70.8711	81.0985	88.6004	100.8697 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 982 (64)
Electric shower(s)	58.4279	52.0597	56.8472	54.2486	55.2666	52.7190	54.4763	55.2666	54.2486	56.8472	55.7783	58.4279 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												664.6139 (64a)
Heat gains from water heating, kWh/month	40.1501	35.3512	37.5777	33.5508	32.7510	29.7890	29.8155	30.9956	31.2799	34.4864	36.0947	39.8244 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.1382	169.5459	153.1382	158.2428	153.1382	158.2428	153.1382	153.1382	158.2428	153.1382	158.2428	153.1382 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	53.9652	52.6059	50.5077	46.5983	44.0201	41.3737	40.0746	41.6608	43.4443	46.3527	50.1315	53.5274 (72)
Total internal gains	577.3582	595.5575	569.1113	553.4026	524.3816	506.7849	486.9832	485.4185	500.2470	514.9547	545.1763	563.5225 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.9200	10.6334	0.6300	0.7000	0.7700	6.2394 (74)						
East	6.3000	19.6403	0.6300	0.7000	0.7700	37.8146 (76)						
South	9.2400	46.7521	0.6300	0.7000	0.7700	132.0215 (78)						
West	4.8600	19.6403	0.6300	0.7000	0.7700	29.1713 (80)						
North	6.6500	26.0000	0.6300	0.7000	1.0000	68.6240 (82)						
Solar gains	273.8708	501.7064	764.8668	1054.4743	1260.7023	1281.8342	1223.5881	1068.2611	866.5879	577.0921	334.8109	229.7932 (83)
Total gains	851.2290	1097.2639	1333.9780	1607.8769	1785.0839	1788.6190	1710.5713	1553.6795	1366.8349	1092.0468	879.9871	793.3157 (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)												21.0000 (85)	
tau	26.6276	26.6992	26.7698	27.1062	27.1701	27.4715	27.4715	27.5281	27.3547	27.1701	27.0412	26.9077	
alpha	2.7752	2.7799	2.7847	2.8071	2.8113	2.8314	2.8314	2.8352	2.8236	2.8113	2.8027	2.7938	
util living area	0.9791	0.9586	0.9202	0.8370	0.7125	0.5576	0.4284	0.4809	0.6985	0.8945	0.9649	0.9827 (86)	
MIT	18.3158	18.7189	19.2906	19.9902	20.5166	20.8301	20.9407	20.9170	20.6642	19.9181	18.9886	18.2567 (87)	
Th 2	19.7964	19.7992	19.8020	19.8150	19.8174	19.8288	19.8288	19.8309	19.8244	19.8174	19.8125	19.8073 (88)	
util rest of house	0.9750	0.9507	0.9048	0.8061	0.6590	0.4767	0.3249	0.3742	0.6236	0.8670	0.9568	0.9792 (89)	
MIT 2	17.3739	17.7725	18.3316	19.0038	19.4760	19.7362	19.8074	19.7984	19.6191	18.9571	18.0523	17.3224 (90)	
Living area fraction												fLA = Living area / (4) = 0.3704 (91)	
LIT	17.7227	18.1230	18.6868	19.3691	19.8614	20.1413	20.2272	20.2127	20.0062	19.3130	18.3991	17.6684 (92)	
Temperature adjustment													0.0000
adjusted MIT	17.7227	18.1230	18.6868	19.3691	19.8614	20.1413	20.2272	20.2127	20.0062	19.3130	18.3991	17.6684 (93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9649	0.9359	0.8870	0.7927	0.6612	0.4994	0.3614	0.4107	0.6363	0.8526	0.9437	0.9704	(94)
Useful gains	821.3830	1026.9594	1183.2392	1274.5362	1180.3370	893.3141	618.2186	638.1029	869.7615	931.1278	830.4714	769.8294	(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	2459.1450	2416.0533	2220.8472	1884.1537	1465.3786	984.0279	644.1089	675.6671	1053.2932	1564.4211	2038.4159	2441.8366	(97)
Space heating kWh	1218.4949	933.4710	771.9803	438.9246	212.0709	0.0000	0.0000	0.0000	0.0000	471.1702	869.7200	1243.9734	(98a)
Space heating requirement - total per year (kWh/year)												6159.8055	
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	1218.4949	933.4710	771.9803	438.9246	212.0709	0.0000	0.0000	0.0000	0.0000	471.1702	869.7200	1243.9734	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6159.8055	
Space heating per m2												(98c) / (4) =	45.6282 (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	1669.2443	1314.0860	1346.8290	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7911	0.8499	0.8159	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1320.5650	1116.7760	1098.8636	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1936.4366	1853.0416	1686.9744	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	443.4276	547.7816	437.5545	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	110.8569	136.9454	109.3886	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												357.1909	(107)
Energy for space heating												45.6282	(99)
Energy for space cooling												2.6459	(108)
Total												48.2740	(109)
Fabric Energy Efficiency (TFEE)												48.3	(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	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	364.5000 (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	1 * 35 = 35.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =
Pressure test	35.0000 / (5) = 0.0960 (8)
Pressure Test Method	Yes Blower Door

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Measured/design AP50 2.3000 (17)
 Infiltration rate 0.2110 (18)
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2110 (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	0.2691	0.2638	0.2585	0.2321	0.2268	0.2005	0.2005	0.1952	0.2110	0.2268	0.2374	0.2480	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													82.8000 (23c)
Effective ac	0.3551	0.3498	0.3445	0.3181	0.3128	0.2865	0.2865	0.2812	0.2970	0.3128	0.3234	0.3340	(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	
Opening Type 1 (Uw = 0.80)			22.3200	0.7752	17.3023			(27)
Rooflights			6.6500	1.2357	8.2177			(27a)
Heatloss Floor 1			135.0000	0.0900	12.1500	110.0000	14850.0000	(28a)
External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000	(29a)
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500	(30)
Total net area of external elements Aum(A, m2)			434.7000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 77.1257			(33)
Internal Wall 1			146.0000			9.0000	1314.0000	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17562.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 130.0900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.8200	0.0140	0.2215
E3 Sill	15.8200	0.0460	0.7277
E4 Jamb	32.1000	0.0050	0.1605
E5 Ground floor (normal)	51.0000	0.0640	3.2640
E11 Eaves (insulation at rafter level)	36.0000	0.0540	1.9440
E13 Gable (insulation at rafter level)	18.0000	0.0750	1.3500
E16 Corner (normal)	10.4000	0.0420	0.4368
R1 Head of roof window	15.0000	0.2400	3.6000
R2 Sill of roof window	15.0000	0.2400	3.6000
R3 Jamb of roof window	20.0000	0.2400	4.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.1045 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 97.2302 (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	42.7075	42.0730	41.4384	38.2656	37.6310	34.4581	34.4581	33.8236	35.7273	37.6310	38.9001	40.1693	(38)
Average = Sum(39)m / 12 =	139.9378	139.3032	138.6686	135.4958	134.8612	131.6884	131.6884	131.0538	132.9575	134.8612	136.1303	137.3995	(39)
													135.3371

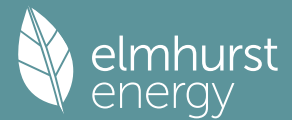
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0366	1.0319	1.0272	1.0037	0.9990	0.9755	0.9755	0.9708	0.9849	0.9990	1.0084	1.0178	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9069 (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	84.1621	82.9122	81.1520	77.9066	75.4765	72.7819	71.3264	73.0742	74.9773	77.8606	81.1729	83.8776	(42b)	
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995	(42c)	
Average daily hot water use (litres/day)													118.3947 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771	(44)
Energy content (annual)	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1966.1152
Water storage loss:	30.5415	26.8487	28.2008	24.1201	22.9023	20.1243	19.5296	20.6191	21.1846	24.2286	26.4901	30.1276	(46)
Store volume													350.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													1.1340 (55)
Total storage loss													

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If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (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	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	67.7004	59.5145	62.5117	53.4661	50.7669	44.6088	43.2906	45.7056	46.9593	53.7067	58.7197	66.7829 (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	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9078	24.7875	20.1585	15.2613	11.4080	9.6311	10.4068	13.5271	18.1560	23.0533	26.9066	28.6835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	90.9951	88.5633	84.0211	74.2585	68.2350	61.9567	58.1863	61.4323	65.2212	72.1865	81.5552	89.7620 (72)
Total internal gains	688.6001	687.7508	666.7285	626.8389	585.1140	544.1262	521.1345	522.7979	543.0670	583.1593	628.2293	668.1457 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.9200	10.6334	0.5700	0.7000	0.7700	5.6452 (74)						
East	6.3000	19.6403	0.5700	0.7000	0.7700	34.2132 (76)						
South	9.2400	46.7521	0.5700	0.7000	0.7700	119.4480 (78)						
West	4.8600	19.6403	0.5700	0.7000	0.7700	26.3931 (80)						
North	6.6500	26.0000	0.6300	0.7000	1.0000	68.6240 (82)						
Solar gains	254.3235	467.4988	716.1538	991.7537	1188.8985	1210.0287	1154.5648	1005.9870	812.9633	538.7213	311.2193	213.1869 (83)
Total gains	942.9236	1155.2496	1382.8823	1618.5925	1774.0125	1754.1549	1675.6993	1528.7849	1356.0303	1121.8806	939.4486	881.3326 (84)

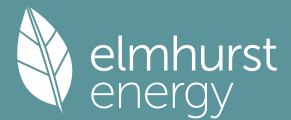
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.8610	35.0198	35.1801	36.0039	36.1733	37.0448	37.0448	37.2242	36.6912	36.1733	35.8361	35.5050
alpha	3.3241	3.3347	3.3453	3.4003	3.4116	3.4697	3.4697	3.4816	3.4461	3.4116	3.3891	3.3670
util living area	0.9702	0.9438	0.8889	0.7777	0.6260	0.4601	0.3401	0.3848	0.6075	0.8509	0.9508	0.9755 (86)
MIT	19.4963	19.7625	20.1304	20.5278	20.7655	20.8751	20.9015	20.8968	20.8162	20.4601	19.9093	19.4629 (87)
Th 2	20.0530	20.0569	20.0607	20.0803	20.0842	20.1038	20.1038	20.1078	20.0960	20.0842	20.0764	20.0685 (88)
util rest of house	0.9651	0.9346	0.8716	0.7465	0.5798	0.4017	0.2731	0.3138	0.5450	0.8211	0.9412	0.9712 (89)
MIT 2	18.2860	18.6229	19.0806	19.5698	19.8367	19.9637	19.9850	19.9862	19.9061	19.5075	18.8268	18.2553 (90)
Living area fraction	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	0.3704 (91)
MIT	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	18.7025 (92)
Temperature adjustment	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	0.0000
adjusted MIT	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	18.7025 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	901.4288	1065.8578	1187.9878	1199.0570	1037.5088	727.6656	485.5600	506.4482	753.5249	911.9430	874.0361	848.8875 (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)

Full SAP Calculation Printout



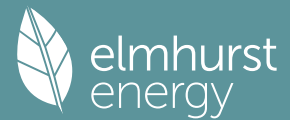
Heat loss rate W	2019.8969	1970.4363	1798.4465	1493.7889	1143.7198	750.7897	490.4651	514.1890	816.7793	1248.8576	1650.9508	1992.6425 (97)
Space heating kWh	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537 (98a)
Space heating requirement - total per year (kWh/year)												3846.4230
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	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3846.4230
Space heating per m2												(98c) / (4) = 28.4920 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												77.2000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	748.9263	547.0891	408.7631	190.9863	71.1189	0.0000	0.0000	0.0000	0.0000	225.5980	503.4407	765.8583 (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)	107.7902	78.7405	58.8318	27.4880	10.2359	0.0000	0.0000	0.0000	0.0000	32.4695	72.4584	110.2272 (215)
Water heating requirement	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (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	27.8049	25.1141	27.8049	26.9080	27.8049	26.9080	27.8049	27.8049	26.9080	27.8049	26.9080	27.8049 (231)
Lighting	24.4275	19.5967	17.6446	12.9272	9.9854	8.1581	9.1090	11.8402	15.3792	20.1784	22.7915	25.1065 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-173.0032	-226.6208	-284.6280	-249.3083	-204.3016	-153.6469	-151.7845	-152.9225	-153.2190	-207.9226	-178.5365	-151.6012 (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	-120.0028	-262.3220	-548.0976	-866.7082	-1174.4426	-1201.8784	-1185.8269	-1015.7553	-762.0901	-417.1258	-169.0109	-93.5948 (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												3461.7807 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												498.2413 (215)
Efficiency of water heater												100.0000
Water heating fuel used												2380.0252 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)												
mechanical ventilation fans (SFP = 0.6440)												286.3804 (230a)
central heating pump												41.0000 (230c)
Total electricity for the above, kWh/year												327.3804 (231)
Electricity for lighting (calculated in Appendix L)												197.1443 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-10104.3504 (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												-3239.7786 (238)

10a. Fuel costs - using Table 12 prices

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	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	3115.6026	9.4000	610.6581 (240)
Space heating - main system 1 (low-rate cost)	346.1781	0.0940	32.5407 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	498.2413	5.1200	25.5100 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.0000 (243)
Low-rate fraction			1.0000 (244)
High-rate cost	0.0000	19.6000	0.0000 (245)
Low-rate cost	2380.0252	9.4000	223.7224 (246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	327.3804	18.5800	55.2772 (249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	197.1443	18.5800	36.6294 (250)
Additional standing charges			7.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2287.4951	18.5800	-425.0166
PV Unit electricity exported	-7816.8553	5.5900	-436.9622
Total			-861.9788 (252)
Total energy cost			129.3590 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2587 (257)
SAP value		95.8062
SAP rating (Section 12)		96 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	3115.6026	0.1638	510.3148 (261)
Space heating - main system 1 (low-rate cost)	346.1781	0.1375	47.6046 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	498.2413	0.0280	13.9508 (263)
Water heating - high rate cost	0.0000	0.0000	0.0000 (264)
Water heating - low rate cost	2380.0252	0.1242	295.6237 (264)
Space and water heating			867.4939 (265)
Pumps, fans and electric keep-hot	327.3804	0.1432	45.6087 (267)
Energy for lighting	197.1443	0.1490	29.3784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2287.4951	0.1452	-332.1319
PV Unit electricity exported	-7816.8553	0.1244	-972.7430
Total			-1304.8748 (269)
Total CO2, kg/year			-362.3938 (272)
CO2 emissions per m2			-2.6800 (273)
EI value			102.6978
EI rating			103 (274)
EI band			A

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

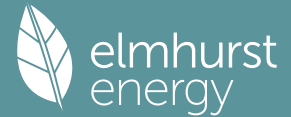
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	364.5000 (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)

Full SAP Calculation Printout



Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
 Number of flues attached to other heater 1 * 35 = 35.0000 (6e)
 Number of blocked chimneys 0 * 20 = 0.0000 (6f)
 Number of intermittent extract fans 0 * 10 = 0.0000 (7a)
 Number of passive vents 0 * 10 = 0.0000 (7b)
 Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = Air changes per hour
 Pressure test 35.0000 / (5) = 0.0960 (8)
 Pressure Test Method Yes
 Measured/design AP50 Blower Door
 Infiltration rate 2.3000 (17)
 Number of sides sheltered 0.2110 (18)
0 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2110 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.5000	6.1000	6.0000	5.2000	5.2000	4.7000	4.6000	4.6000	5.0000	5.9000	6.0000	6.4000 (22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000 (22a)
Adj infilt rate	0.3429	0.3218	0.3165	0.2743	0.2743	0.2480	0.2427	0.2427	0.2638	0.3113	0.3165	0.3376 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.4289	0.4078	0.4025	0.3603	0.3603	0.3340	0.3287	0.3287	0.3498	0.3973	0.4025	0.4236 (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
Opening Type 1 (Uw = 0.80)			22.3200	0.7752	17.3023		(27)
Rooflights			6.6500	1.2357	8.2177		(27a)
Heatloss Floor 1			135.0000	0.0900	12.1500	110.0000	14850.0000 (28a)
External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000 (29a)
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500 (30)
Total net area of external elements Aum(A, m2)			434.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 77.1257		(33)
Internal Wall 1			146.0000			9.0000	1314.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17562.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 130.0900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.8200	0.0140	0.2215
E3 Sill	15.8200	0.0460	0.7277
E4 Jamb	32.1000	0.0050	0.1605
E5 Ground floor (normal)	51.0000	0.0640	3.2640
E11 Eaves (insulation at rafter level)	36.0000	0.0540	1.9440
E13 Gable (insulation at rafter level)	18.0000	0.0750	1.3500
E16 Corner (normal)	10.4000	0.0420	0.4368
R1 Head of roof window	15.0000	0.2400	3.6000
R2 Sill of roof window	15.0000	0.2400	3.6000
R3 Jamb of roof window	20.0000	0.2400	4.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.1045 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 97.2302 (37)

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

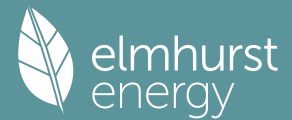
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.5915	49.0532	48.4187	43.3421	43.3421	40.1693	39.5347	39.5347	42.0730	47.7841	48.4187	50.9569 (38)
Average = Sum(39)m / 12 =	148.8217	146.2834	145.6489	140.5723	140.5723	137.3995	136.7649	136.7649	139.3032	145.0143	145.6489	148.1872 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1024	1.0836	1.0789	1.0413	1.0413	1.0178	1.0131	1.0131	1.0319	1.0742	1.0789	1.0977 (40)
HLP (average)												1.0562
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9069 (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	84.1621	82.9122	81.1520	77.9066	75.4765	72.7819	71.3264	73.0742	74.9773	77.8606	81.1729	83.8776 (42b)	
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995 (42c)	
Average daily hot water use (litres/day)												118.3947 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Energy conte	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771 (44)
Energy content (annual)	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509 (45)
Distribution loss (46) _m = 0.15 x (45) _m										Total = Sum(45) _m =		1966.1152
	30.5415	26.8487	28.2008	24.1201	22.9023	20.1243	19.5296	20.6191	21.1846	24.2286	26.4901	30.1276 (46)
Water storage loss:												
Store volume												350.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												1.1340 (55)
Total storage loss												
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage												
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (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												
	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (64)
												Total per year (kWh/year) = Sum(64) _m = 2380.0252 (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												
	67.7004	59.5145	62.5117	53.4661	50.7669	44.6088	43.2906	45.7056	46.9593	53.7067	58.7197	66.7829 (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
	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	27.9078	24.7875	20.1585	15.2613	11.4080	9.6311	10.4068	13.5271	18.1560	23.0533	26.9066	28.6835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)												
	90.9951	88.5633	84.0211	74.2585	68.2350	61.9567	58.1863	61.4323	65.2212	72.1865	81.5552	89.7620 (72)
Total internal gains												
	688.6001	687.7508	666.7285	626.8389	585.1140	544.1262	521.1345	522.7979	543.0670	583.1593	628.2293	668.1457 (73)

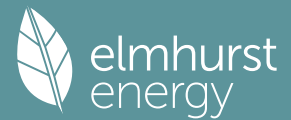
6. Solar gains

[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						
North		1.9200	13.8487	0.5700	0.7000	0.7700	7.3522 (74)					
East		6.3000	25.8938	0.5700	0.7000	0.7700	45.1069 (76)					
South		9.2400	58.0763	0.5700	0.7000	0.7700	148.3806 (78)					
West		4.8600	25.8938	0.5700	0.7000	0.7700	34.7967 (80)					
North		6.6500	35.0000	0.6300	0.7000	1.0000	92.3785 (82)					
Solar gains	328.0149	516.1363	794.9940	1118.7059	1299.1144	1380.6921	1205.4533	1125.3234	921.1936	605.8763	388.8808	272.1398 (83)
Total gains	1016.6150	1203.8871	1461.7224	1745.5448	1884.2284	1924.8182	1726.5878	1648.1213	1464.2606	1189.0355	1017.1101	940.2855 (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	32.7800	33.3488	33.4941	34.7037	34.7037	35.5050	35.6698	35.6698	35.0198	33.6406	33.4941	32.9204
alpha	3.1853	3.2233	3.2329	3.3136	3.3136	3.3670	3.3780	3.3780	3.3347	3.2427	3.2329	3.1947
util living area												
	0.9530	0.9257	0.8644	0.7549	0.6188	0.4684	0.3995	0.4022	0.5708	0.8100	0.9192	0.9593 (86)
MIT	19.6888	19.8912	20.2022	20.5413	20.7531	20.8622	20.8875	20.8879	20.8246	20.5269	20.1085	19.6748 (87)
Th 2	19.9989	20.0143	20.0181	20.0491	20.0491	20.0685	20.0725	20.0725	20.0569	20.0220	20.0181	20.0027 (88)
util rest of house												
	0.9442	0.9128	0.8427	0.7215	0.5719	0.4119	0.3326	0.3322	0.5044	0.7699	0.9019	0.9513 (89)
MIT 2	18.4912	18.7529	19.1342	19.5564	19.7898	19.9163	19.9427	19.9433	19.8754	19.5335	19.0319	18.4776 (90)
Living area fraction												
	18.9347	19.1745	19.5297	19.9212	20.1466	20.2667	20.2926	20.2932	20.2269	19.9014	19.4306	18.9210 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9347	19.1745	19.5297	19.9212	20.1466	20.2667	20.2926	20.2932	20.2269	19.9014	19.4306	18.9210 (93)

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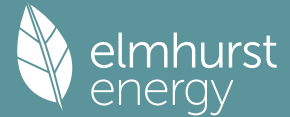
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9324	0.8995	0.8304	0.7167	0.5769	0.4242	0.3488	0.3492	0.5169	0.7644	0.8894	0.9403	(94)
Useful gains	947.9240	1082.9529	1213.8280	1250.9591	1086.9834	816.5024	602.2298	575.4582	756.8784	908.8926	904.6570	884.1653	(95)
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000	(96)
Heat loss rate W	1910.0873	1883.3205	1766.6839	1535.2125	1201.4141	847.2961	614.4320	587.1557	811.7115	1189.3256	1519.2085	1855.4476	(97)
Space heating kWh	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340	(98a)
Space heating requirement - total per year (kWh/year)												3328.5735	
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	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3328.5735	
Space heating per m2										(98c) / (4) =		24.6561	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)	
Fraction of space heat from main system(s)														0.9000	(202)
Efficiency of main space heating system 1 (in %)														100.0000	(206)
Efficiency of main space heating system 2 (in %)														0.0000	(207)
Efficiency of secondary/supplementary heating system, %														77.2000	(208)
Space heating requirement	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340	(98)		
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)		
Space heating fuel (main heating system)	644.2645	484.0624	370.1923	184.1962	76.6228	0.0000	0.0000	0.0000	0.0000	187.7780	398.2293	650.3706	(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)	92.7266	69.6693	53.2804	26.5107	11.0280	0.0000	0.0000	0.0000	0.0000	27.0262	57.3157	93.6054	(215)		
Water heating requirement	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	(64)		
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)		
Fuel for water heating, kWh/month	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049	(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	27.8049	25.1141	27.8049	26.9080	27.8049	26.9080	27.8049	27.8049	26.9080	27.8049	26.9080	27.8049	(231)		
Lighting	24.4275	19.5967	17.6446	12.9272	9.9854	8.1581	9.1090	11.8402	15.3792	20.1784	22.7915	25.1065	(232)		
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-201.8023	-233.8084	-289.9494	-253.2699	-206.8531	-150.6518	-150.9969	-151.7478	-154.3113	-210.1584	-196.2552	-176.6375	(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	-176.8131	-306.7436	-634.8315	-1004.8475	-1298.0320	-1394.1685	-1243.9170	-1154.4348	-882.8296	-493.5370	-238.7794	-136.9845	(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													2995.7162	(211)	
Space heating fuel - main system 2													0.0000	(213)	
Space heating fuel - secondary													431.1624	(215)	
Efficiency of water heater													100.0000		
Water heating fuel used													2380.0252	(219)	
Space cooling fuel													0.0000	(221)	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)															
mechanical ventilation fans (SFP = 0.6440)														286.3804	(230a)
central heating pump														41.0000	(230c)
Total electricity for the above, kWh/year														327.3804	(231)
Electricity for lighting (calculated in Appendix L)														197.1443	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation														-11342.3605	(233)
Wind generation														0.0000	(234)
Hydro-electric generation (Appendix N)														0.0000	(235a)

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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	-5010.9321 (238)

10a. Fuel costs - using BEDF prices (522)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	2696.1446	12.5000	684.8207 (240)
Space heating - main system 1 (low-rate cost)	299.5716	0.1250	37.4465 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	431.1624	7.7200	33.2857 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.0000 (243)
Low-rate fraction			1.0000 (244)
High-rate cost	0.0000	25.4000	0.0000 (245)
Low-rate cost	2380.0252	12.5000	297.5032 (246)
Energy for instantaneous electric shower(s)	0.0000	24.1100	0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*25.40 + 0.10*12.50)	327.3804	24.1100	71.9122 (249)
Energy for lighting (0.90*25.40 + 0.10*12.50)	197.1443	24.1100	47.5315 (250)
Additional standing charges			5.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2376.4420	24.1100	-572.9602
PV Unit electricity exported	-8965.9186	5.5900	-501.1948
Total			-1074.1550 (252)
Total energy cost			103.3448 (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 (high-rate cost)	2696.1446	0.1637	441.2537 (261)
Space heating - main system 1 (low-rate cost)	299.5716	0.1374	41.1607 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	431.1624	0.0280	12.0725 (263)
Water heating - high rate cost	0.0000	0.0000	0.0000 (264)
Water heating - low rate cost	2380.0252	0.1242	295.6237 (264)
Space and water heating			790.1107 (265)
Pumps, fans and electric keep-hot	327.3804	0.1432	45.6087 (267)
Energy for lighting	197.1443	0.1490	29.3784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2376.4420	0.1459	-346.7636
PV Unit electricity exported	-8965.9186	0.1257	-1127.3637
Total			-1474.1273 (269)
Total CO2, kg/year			-609.0295 (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 (high-rate cost)	2696.1446	1.4491	4340.9451 (275)
Space heating - main system 1 (low-rate cost)	299.5716	1.4974	448.5817 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	431.1624	1.0460	450.9958 (277)
Water heating - high rate cost	0.0000	0.0000	0.0000 (278)
Water heating - low rate cost	2380.0252	1.4445	3438.0220 (278)
Space and water heating			8678.5447 (279)
Pumps, fans and electric keep-hot	327.3804	1.5335	496.1536 (281)
Energy for lighting	197.1443	1.5547	306.5091 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2376.4420	1.5435	-3668.0377
PV Unit electricity exported	-8965.9186	0.4616	-4138.4550
Total			-7806.4927 (283)
Total Primary energy kWh/year			1674.7146 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating:	A 96
Current environmental impact rating:	A 103

N Solar water heating

Recommended

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U Solar photovoltaic panels			Already installed
V2 Wind turbine			Recommended
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 75	-70 kg (11.5%)
V2 Wind turbine	+ 17.0	-£ 663	-507 kg (74.7%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£75	0.52 kg/m ²	A 97 A 103
Wind turbine	£663	3.76 kg/m ²	A 114 A 107
Total Savings	£738	4.28 kg/m²	

Potential energy efficiency rating: A 114
 Potential environmental impact rating: A 107

Fuel prices for cost data on this page from database revision number 522 TEST (30 Jun 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	£1144	£1074	£70
Wood	£33	£33	£0
Space heating	£832	£852	-£19
Water heating	£298	£208	£90
Lighting	£48	£48	£0
Generated (PV)	-£1074	-£1079	£5
Generated (wind)	-£0	-£663	£663
Total cost of fuels	£103	-£635	£738
Total cost of uses	£104	-£634	£739
Delivered energy	-37 kWh/m ²	-68 kWh/m ²	31 kWh/m ²
Carbon dioxide emissions	-0.6 tonnes	-1.2 tonnes	0.6 tonnes
CO2 emissions per m ²	-5 kg/m ²	-9 kg/m ²	4 kg/m ²
Primary energy	12 kWh/m ²	-27 kWh/m ²	39 kWh/m ²

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

1. Overall dwelling characteristics

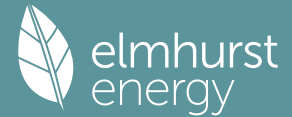
	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 364.5000 (5)

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	1 * 35 =	35.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	35.0000 / (5) =	0.0960 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.3000 (17)
Infiltration rate		0.2110 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2110 (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)

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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	0.2691	0.2638	0.2585	0.2321	0.2268	0.2005	0.2005	0.1952	0.2110	0.2268	0.2374	0.2480 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3551	0.3498	0.3445	0.3181	0.3128	0.2865	0.2865	0.2812	0.2970	0.3128	0.3234	0.3340 (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
Opening Type 1 (Uw = 0.80)			22.3200	0.7752	17.3023		(27)
Rooflights			6.6500	1.2357	8.2177		(27a)
Heatloss Floor 1			135.0000	0.0900	12.1500	110.0000	14850.0000 (28a)
External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000 (29a)
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500 (30)
Total net area of external elements Aum(A, m2)			434.7000			(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	77.1257	(33)
Internal Wall 1			146.0000			9.0000	1314.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17562.1500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 130.0900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.8200	0.0140	0.2215
E3 Sill	15.8200	0.0460	0.7277
E4 Jamb	32.1000	0.0050	0.1605
E5 Ground floor (normal)	51.0000	0.0640	3.2640
E11 Eaves (insulation at rafter level)	36.0000	0.0540	1.9440
E13 Gable (insulation at rafter level)	18.0000	0.0750	1.3500
E16 Corner (normal)	10.4000	0.0420	0.4368
R1 Head of roof window	15.0000	0.2400	3.6000
R2 Sill of roof window	15.0000	0.2400	3.6000
R3 Jamb of roof window	20.0000	0.2400	4.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 20.1045 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 97.2302 (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	42.7075	42.0730	41.4384	38.2656	37.6310	34.4581	34.4581	33.8236	35.7273	37.6310	38.9001	40.1693 (38)
Average = Sum(39)m / 12 =	139.9378	139.3032	138.6686	135.4958	134.8612	131.6884	131.6884	131.0538	132.9575	134.8612	136.1303	137.3995 (39)
	135.3371											

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0366	1.0319	1.0272	1.0037	0.9990	0.9755	0.9755	0.9708	0.9849	0.9990	1.0084	1.0178 (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												2.9069 (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	84.1621	82.9122	81.1520	77.9066	75.4765	72.7819	71.3264	73.0742	74.9773	77.8606	81.1729	83.8776 (42b)
Hot water usage for other uses	44.3995	42.7850	41.1704	39.5559	37.9414	36.3269	36.3269	37.9414	39.5559	41.1704	42.7850	44.3995 (42c)
Average daily hot water use (litres/day)												118.3947 (43)

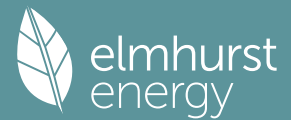
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771 (44)
Energy content (annual)	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1966.1152
Distribution loss	30.5415	26.8487	28.2008	24.1201	22.9023	20.1243	19.5296	20.6191	21.1846	24.2286	26.4901	30.1276 (46)

Water storage loss:

Store volume												350.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												1.1340 (55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)

If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	238.7642	210.7431	223.1591	194.8203	187.8363	168.1819	165.3513	172.6145	175.2509	196.6781	210.6207	236.0049 (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)

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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													609.1883 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													609.1883
Solar input	-0.0000	-16.2411	-57.3966	-78.4381	-102.3001	-94.1738	-93.4324	-81.9897	-56.6807	-28.5358	-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	238.7642	194.5020	165.7625	116.3823	85.5362	74.0081	71.9189	90.6248	118.5702	168.1422	210.6207	236.0049	(64)
													Total per year (kWh/year) = Sum(64)m = 1770.8369 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	67.7004	59.5145	62.5117	53.4661	50.7669	44.6088	43.2906	45.7056	46.9593	53.7067	58.7197	66.7829	(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)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	27.9078	24.7875	20.1585	15.2613	11.4080	9.6311	10.4068	13.5271	18.1560	23.0533	26.9066	28.6835	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141	(68)
Pumps, fans	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	(71)
Total internal gains	90.9951	88.5633	84.0211	74.2585	68.2350	61.9567	58.1863	61.4323	65.2212	72.1865	81.5552	89.7620	(72)
	688.6001	687.7508	666.7285	626.8389	585.1140	544.1262	521.1345	522.7979	543.0670	583.1593	628.2293	668.1457	(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	
North		1.9200	10.6334	0.5700	0.7000	0.7700	5.6452 (74)
East		6.3000	19.6403	0.5700	0.7000	0.7700	34.2132 (76)
South		9.2400	46.7521	0.5700	0.7000	0.7700	119.4480 (78)
West		4.8600	19.6403	0.5700	0.7000	0.7700	26.3931 (80)
North		6.6500	26.0000	0.6300	0.7000	1.0000	68.6240 (82)

Solar gains	254.3235	467.4988	716.1538	991.7537	1188.8985	1210.0287	1154.5648	1005.9870	812.9633	538.7213	311.2193	213.1869	(83)
Total gains	942.9236	1155.2496	1382.8823	1618.5925	1774.0125	1754.1549	1675.6993	1528.7849	1356.0303	1121.8806	939.4486	881.3326	(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, n11,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	34.8610	35.0198	35.1801	36.0039	36.1733	37.0448	37.0448	37.2242	36.6912	36.1733	35.8361	35.5050	
util living area	3.3241	3.3347	3.3453	3.4003	3.4116	3.4697	3.4697	3.4816	3.4461	3.4116	3.3891	3.3670	
	0.9702	0.9438	0.8889	0.7777	0.6260	0.4601	0.3401	0.3848	0.6075	0.8509	0.9508	0.9755	(86)
MIT	19.4963	19.7625	20.1304	20.5278	20.7655	20.8751	20.9015	20.8968	20.8162	20.4601	19.9093	19.4629	(87)
Th 2	20.0530	20.0569	20.0607	20.0803	20.0842	20.1038	20.1038	20.1078	20.0960	20.0842	20.0764	20.0685	(88)
util rest of house	0.9651	0.9346	0.8716	0.7465	0.5798	0.4017	0.2731	0.3138	0.5450	0.8211	0.9412	0.9712	(89)
MIT 2	18.2860	18.6229	19.0806	19.5698	19.8367	19.9637	19.9850	19.9862	19.9061	19.5075	18.8268	18.2553	(90)
Living area fraction	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	18.7025	(91)
MIT	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	18.7025	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7343	19.0449	19.4694	19.9246	20.1807	20.3013	20.3244	20.3235	20.2432	19.8603	19.2277	18.7025	(93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9560	0.9226	0.8591	0.7408	0.5848	0.4148	0.2898	0.3313	0.5557	0.8129	0.9304	0.9632	(94)
Useful gains	901.4288	1065.8578	1187.9878	1199.0570	1037.5088	727.6656	485.5600	506.4482	753.5249	911.9430	874.0361	848.8875	(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	2019.8969	1970.4363	1798.4465	1493.7889	1143.7198	750.7897	490.4651	514.1890	816.7793	1248.8576	1650.9508	1992.6425	(97)
Space heating kWh	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537	(98a)
Space heating requirement - total per year (kWh/year)												3846.4230	
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	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3846.4230	
Space heating per m2										(98c) / (4) =		28.4920	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)		0.1000	(201)
Fraction of space heat from main system(s)		0.9000	(202)
Efficiency of main space heating system 1 (in %)		100.0000	(206)
Efficiency of main space heating system 2 (in %)		0.0000	(207)
Efficiency of secondary/supplementary heating system, %		77.2000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.1403	607.8767	454.1813	212.2070	79.0210	0.0000	0.0000	0.0000	0.0000	250.6644	559.3785	850.9537	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	748.9263	547.0891	408.7631	190.9863	71.1189	0.0000	0.0000	0.0000	0.0000	225.5980	503.4407	765.8583	(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)	107.7902	78.7405	58.8318	27.4880	10.2359	0.0000	0.0000	0.0000	0.0000	32.4695	72.4584	110.2272	(215)

Water heating

Water heating requirement	238.7642	194.5020	165.7625	116.3823	85.5362	74.0081	71.9189	90.6248	118.5702	168.1422	210.6207	236.0049	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	238.7642	194.5020	165.7625	116.3823	85.5362	74.0081	71.9189	90.6248	118.5702	168.1422	210.6207	236.0049	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	34.5994	31.2511	34.5994	33.4833	34.5994	33.4833	34.5994	34.5994	33.4833	34.5994	33.4833	34.5994	(231)
Lighting	24.4275	19.5967	17.6446	12.9272	9.9854	8.1581	9.1090	11.8402	15.3792	20.1784	22.7915	25.1065	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-173.2946	-227.2525	-286.0110	-251.6542	-207.5917	-157.2388	-155.4940	-156.4210	-156.1725	-209.3694	-179.0267	-151.8340	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-119.7115	-261.6903	-546.7146	-864.3623	-1171.1526	-1198.2864	-1182.1174	-1012.2568	-759.1366	-415.6790	-168.5206	-93.3620	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3461.7807	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												498.2413	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												1770.8369	(219)
Space cooling fuel												0.0000	(221)

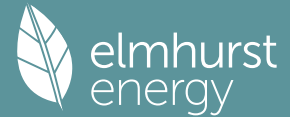
Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)			
mechanical ventilation fans (SFP = 0.6440)			286.3804 (230a)
central heating pump			41.0000 (230c)
pump for solar water heating			80.0000 (230g)
Total electricity for the above, kWh/year			407.3804 (231)
Electricity for lighting (calculated in Appendix L)			197.1443 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation			-10104.3504 (233)
Wind generation			-3575.5408 (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)

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Total delivered energy for all uses

-7344.5076 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1 (high-rate cost)	3115.6026	9.4000	610.6581 (240)
Space heating - main system 1 (low-rate cost)	346.1781	0.0940	32.5407 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	498.2413	5.1200	25.5100 (242)
Water heating (electric off-peak tariff)			
High-rate fraction			0.0000 (243)
Low-rate fraction			1.0000 (244)
High-rate cost	0.0000	19.6000	0.0000 (245)
Low-rate cost	1770.8369	9.4000	166.4587 (246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000 (247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	327.3804	18.5800	55.2772 (249)
Pump for solar water heating	80.0000	18.5800	14.8640 (249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	197.1443	18.5800	36.6294 (250)
Additional standing charges			7.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2311.3602	18.5800	-429.4507
PV Unit electricity exported	-7792.9902	5.5900	-435.6282
Total			-865.0789 (252)
Wind Turbine electricity used in dwelling	-2502.8785	0.0000	-465.0348
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-524.9966 (252)
Total energy cost			-441.1374 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = -0.8823 (257)$
SAP value	114.3017
SAP rating (Section 12)	114 (258)
SAP band	A

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

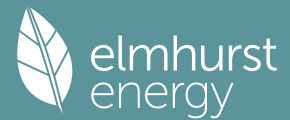
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 (high-rate cost)	3115.6026	0.1638	510.3148 (261)
Space heating - main system 1 (low-rate cost)	346.1781	0.1375	47.6046 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	498.2413	0.0280	13.9508 (263)
Water heating - high rate cost	0.0000	0.0000	0.0000 (264)
Water heating - low rate cost	1770.8369	0.1283	227.1844 (264)
Space and water heating			799.0547 (265)
Pumps, fans and electric keep-hot	407.3804	0.1432	57.0649 (267)
Energy for lighting	197.1443	0.1490	29.3784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2311.3602	0.1451	-335.2631
PV Unit electricity exported	-7792.9902	0.1245	-969.8399
Total			-1305.1030 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1455	-358.4191
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-507.2105 (269)
Total CO2, kg/year			-926.8156 (272)
CO2 emissions per m2			-6.8700 (273)
EI value			106.8996
EI rating			107 (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	135.0000 (1b)	x 2.7000 (2b)	= 364.5000 (1b) -

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Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 135.0000 (4)
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 364.5000 (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 1 * 35 = 35.0000 (6e)
 Number of blocked chimneys 0 * 20 = 0.0000 (6f)
 Number of intermittent extract fans 0 * 10 = 0.0000 (7a)
 Number of passive vents 0 * 10 = 0.0000 (7b)
 Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 35.0000 / (5) = 0.0960 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 2.3000 (17)
 Infiltration rate 0.2110 (18)
 Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2110 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.5000	6.1000	6.0000	5.2000	5.2000	4.7000	4.6000	4.6000	5.0000	5.9000	6.0000	6.4000 (22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000 (22a)
Adj infilt rate	0.3429	0.3218	0.3165	0.2743	0.2743	0.2480	0.2427	0.2427	0.2638	0.3113	0.3165	0.3376 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.4289	0.4078	0.4025	0.3603	0.3603	0.3340	0.3287	0.3287	0.3498	0.3973	0.4025	0.4236 (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					
Opening Type 1 (Uw = 0.80)			22.3200	0.7752	17.3023		(27)					
Rooflights			6.6500	1.2357	8.2177		(27a)					
Heatloss Floor 1			135.0000	0.0900	12.1500	110.0000	14850.0000 (28a)					
External Wall 1	137.7000	22.3200	115.3800	0.1400	16.1532	0.0000	0.0000 (29a)					
External Roof 1	162.0000	6.6500	155.3500	0.1500	23.3025	9.0000	1398.1500 (30)					
Total net area of external elements Aum(A, m2)			434.7000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 77.1257		(33)					
Internal Wall 1			146.0000			9.0000	1314.0000 (32c)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17562.1500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							130.0900 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value		Total					
E2 Other lintels (including other steel lintels)				15.8200	0.0140		0.2215					
E3 Sill				15.8200	0.0460		0.7277					
E4 Jamb				32.1000	0.0050		0.1605					
E5 Ground floor (normal)				51.0000	0.0640		3.2640					
E11 Eaves (insulation at rafter level)				36.0000	0.0540		1.9440					
E13 Gable (insulation at rafter level)				18.0000	0.0750		1.3500					
E16 Corner (normal)				10.4000	0.0420		0.4368					
R1 Head of roof window				15.0000	0.2400		3.6000					
R2 Sill of roof window				15.0000	0.2400		3.6000					
R3 Jamb of roof window				20.0000	0.2400		4.8000					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.1045 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 97.2302 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.5915	49.0532	48.4187	43.3421	43.3421	40.1693	39.5347	39.5347	42.0730	47.7841	48.4187	50.9569 (38)
Average = Sum(39)m / 12 =	148.8217	146.2834	145.6489	140.5723	140.5723	137.3995	136.7649	136.7649	139.3032	145.0143	145.6489	148.1872 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1024	1.0836	1.0789	1.0413	1.0413	1.0178	1.0131	1.0131	1.0319	1.0742	1.0789	1.0977 (40)
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												2.9069 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												83.8776 (42b)
Hot water usage for other uses												44.3995 (42c)
Average daily hot water use (litres/day)												118.3947 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	128.5616	125.6972	122.3225	117.4625	113.4179	109.1087	107.6532	111.0156	114.5332	119.0311	123.9579	128.2771 (44)
Energy content (annual)	203.6102	178.9911	188.0051	160.8003	152.6823	134.1619	130.1973	137.4605	141.2309	161.5241	176.6007	200.8509 (45)
Distribution loss (46) _m = 0.15 x (45) _m												1966.1152
Water storage loss:												
Store volume												350.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												1.1340 (55)
Total storage loss												35.1540 (56)
If cylinder contains dedicated solar storage												
Primary loss												35.1540 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month												236.0049 (62)
WWHRS												0.0000 (63a)
PV diverter												-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												716.4337 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												716.4337
Solar input	-6.1630	-23.5498	-68.4415	-91.2947	-112.3038	-107.5243	-96.9362	-93.0431	-68.3749	-38.6522	-10.1503	-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	232.6011	187.1933	154.7176	103.5257	75.5325	60.6577	68.4151	79.5714	106.8760	158.0259	200.4704	236.0049 (64)
Electric shower(s)												1663.5915 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	67.7004	59.5145	62.5117	53.4661	50.7669	44.6088	43.2906	45.7056	46.9593	53.7067	58.7197	66.7829 (65)

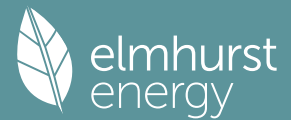
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66) _m	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9078	24.7875	20.1585	15.2613	11.4080	9.6311	10.4068	13.5271	18.1560	23.0533	26.9066	28.6835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	90.9951	88.5633	84.0211	74.2585	68.2350	61.9567	58.1863	61.4323	65.2212	72.1865	81.5552	89.7620 (72)
Total internal gains	688.6001	687.7508	666.7285	626.8389	585.1140	544.1262	521.1345	522.7979	543.0670	583.1593	628.2293	668.1457 (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	
North	1.9200	13.8487	0.5700	0.7000	0.7700	7.3522 (74)
East	6.3000	25.8938	0.5700	0.7000	0.7700	45.1069 (76)

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South			9.2400		58.0763		0.5700		0.7000		0.7700		148.3806 (78)
West			4.8600		25.8938		0.5700		0.7000		0.7700		34.7967 (80)
North			6.6500		35.0000		0.6300		0.7000		1.0000		92.3785 (82)

Solar gains	328.0149	516.1363	794.9940	1118.7059	1299.1144	1380.6921	1205.4533	1125.3234	921.1936	605.8763	388.8808	272.1398	(83)
Total gains	1016.6150	1203.8871	1461.7224	1745.5448	1884.2284	1924.8182	1726.5878	1648.1213	1464.2606	1189.0355	1017.1101	940.2855	(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	32.7800	33.3488	33.4941	34.7037	34.7037	35.5050	35.6698	35.6698	35.0198	33.6406	33.4941	32.9204
alpha	3.1853	3.2233	3.2329	3.3136	3.3136	3.3670	3.3780	3.3780	3.3347	3.2427	3.2329	3.1947
util living area	0.9530	0.9257	0.8644	0.7549	0.6188	0.4684	0.3995	0.4022	0.5708	0.8100	0.9192	0.9593 (86)
MIT	19.6888	19.8912	20.2022	20.5413	20.7531	20.8622	20.8875	20.8879	20.8246	20.5269	20.1085	19.6748 (87)
Th 2	19.9989	20.0143	20.0181	20.0491	20.0491	20.0685	20.0725	20.0725	20.0569	20.0220	20.0181	20.0027 (88)
util rest of house	0.9442	0.9128	0.8427	0.7215	0.5719	0.4119	0.3326	0.3322	0.5044	0.7699	0.9019	0.9513 (89)
MIT 2	18.4912	18.7529	19.1342	19.5564	19.7898	19.9163	19.9427	19.9433	19.8754	19.5335	19.0319	18.4776 (90)
Living area fraction									fLA = Living area / (4) =			0.3704 (91)
MIT	18.9347	19.1745	19.5297	19.9212	20.1466	20.2667	20.2926	20.2932	20.2269	19.9014	19.4306	18.9210 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9347	19.1745	19.5297	19.9212	20.1466	20.2667	20.2926	20.2932	20.2269	19.9014	19.4306	18.9210 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9324	0.8995	0.8304	0.7167	0.5769	0.4242	0.3488	0.3492	0.5169	0.7644	0.8894	0.9403 (94)
Useful gains	947.9240	1082.9529	1213.8280	1250.9591	1086.9834	816.5024	602.2298	575.4582	756.8784	908.8926	904.6570	884.1653 (95)
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000 (96)
Heat loss rate W	1910.0873	1883.3205	1766.6839	1535.2125	1201.4141	847.2961	614.4320	587.1557	811.7115	1189.3256	1519.2085	1855.4476 (97)
Space heating kWh	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340 (98a)
Space heating requirement - total per year (kWh/year)												3328.5735
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	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3328.5735
Space heating per m2										(98c) / (4) =		24.6561 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												77.2000 (208)
Space heating requirement	715.8495	537.8471	411.3248	204.6624	85.1365	0.0000	0.0000	0.0000	0.0000	208.6422	442.4770	722.6340 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	644.2645	484.0624	370.1923	184.1962	76.6228	0.0000	0.0000	0.0000	0.0000	187.7780	398.2293	650.3706 (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)	92.7266	69.6693	53.2804	26.5107	11.0280	0.0000	0.0000	0.0000	0.0000	27.0262	57.3157	93.6054 (215)
Water heating												
Water heating requirement	232.6011	187.1933	154.7176	103.5257	75.5325	60.6577	68.4151	79.5714	106.8760	158.0259	200.4704	236.0049 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	232.6011	187.1933	154.7176	103.5257	75.5325	60.6577	68.4151	79.5714	106.8760	158.0259	200.4704	236.0049 (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	34.5994	31.2511	34.5994	33.4833	34.5994	33.4833	34.5994	34.5994	33.4833	34.5994	33.4833	34.5994 (231)
Lighting	24.4275	19.5967	17.6446	12.9272	9.9854	8.1581	9.1090	11.8402	15.3792	20.1784	22.7915	25.1065 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-202.2468	-234.5687	-291.5440	-255.8488	-210.2752	-154.4201	-154.7680	-155.4249	-157.4840	-211.8706	-196.9841	-176.9955 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-176.3686	-305.9833	-633.2369	-1002.2685	-1294.6099	-1390.4003	-1240.1459	-1150.7577	-879.6568	-491.8248	-238.0505	-136.6265		(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028		(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)
(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													2995.7162	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													431.1624	(215)
Efficiency of water heater													100.0000	
Water heating fuel used													1663.5915	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)														
mechanical ventilation fans (SFP = 0.6440)													286.3804	(230a)
central heating pump													41.0000	(230c)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													407.3804	(231)
Electricity for lighting (calculated in Appendix L)													197.1443	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-11342.3605	(233)
Wind generation													-3575.5408	(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													-9222.9065	(238)

10a. Fuel costs - using BEDF prices (522)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	2696.1446	12.5000	684.8207	(240)
Space heating - main system 1 (low-rate cost)	299.5716	0.1250	37.4465	(240)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	431.1624	7.7200	33.2857	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.0000	(243)
Low-rate fraction			1.0000	(244)
High-rate cost	0.0000	25.4000	0.0000	(245)
Low-rate cost	1663.5915	12.5000	207.9489	(246)
Energy for instantaneous electric shower(s)	0.0000	24.1100	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*25.40 + 0.10*12.50)	327.3804	24.1100	71.9122	(249)
Pump for solar water heating	80.0000	24.1100	19.2880	(249)
Energy for lighting (0.90*25.40 + 0.10*12.50)	197.1443	24.1100	47.5315	(250)
Additional standing charges			5.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2402.4308	24.1100	-579.2261	
PV Unit electricity exported	-8939.9298	5.5900	-499.7421	
Total			-1078.9681	(252)
Wind Turbine electricity used in dwelling	-2502.8785	0.0000	-603.4440	
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618	
Total			-663.4058	(252)
Total energy cost			-635.1404	(255)

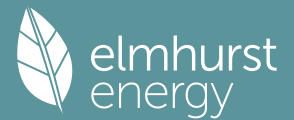
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	2696.1446	0.1637	441.2537	(261)
Space heating - main system 1 (low-rate cost)	299.5716	0.1374	41.1607	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	431.1624	0.0280	12.0725	(263)
Water heating - high rate cost	0.0000	0.0000	0.0000	(264)
Water heating - low rate cost	1663.5915	0.1288	214.3465	(264)
Space and water heating			708.8335	(265)
Pumps, fans and electric keep-hot	407.3804	0.1432	57.0649	(267)
Energy for lighting	197.1443	0.1490	29.3784	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2402.4308	0.1458	-350.2005	
PV Unit electricity exported	-8939.9298	0.1257	-1124.1496	
Total			-1474.3501	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1455	-358.4191	
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915	
Total			-507.2105	(269)
Total CO2, kg/year			-1186.2839	(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 (high-rate cost)	2696.1446	1.4491	4340.9451 (275)
Space heating - main system 1 (low-rate cost)	299.5716	1.4974	448.5817 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	431.1624	1.0460	450.9958 (277)
Water heating - high rate cost	0.0000	0.0000	0.0000 (278)
Water heating - low rate cost	1663.5915	1.4631	2434.0318 (278)
Space and water heating			7674.5544 (279)
Pumps, fans and electric keep-hot	407.3804	1.5335	618.8324 (281)
Energy for lighting	197.1443	1.5547	306.5091 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2402.4308	1.5430	-3706.8476
PV Unit electricity exported	-8939.9298	0.4616	-4126.6604
Total			-7833.5080 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.3899	-3838.1272
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4388.1884 (283)
Total Primary energy kWh/year			-3621.8005 (286)

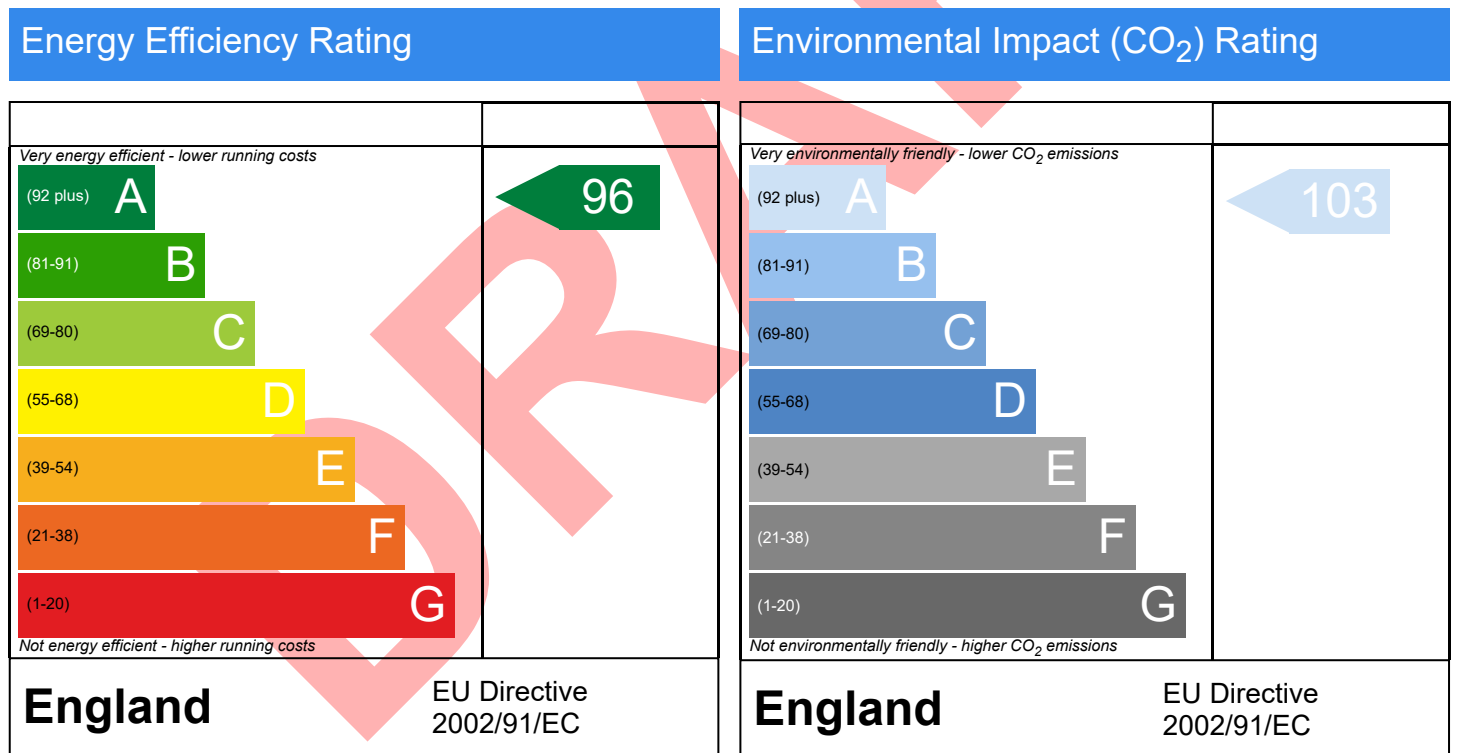
Predicted Energy Assessment



Dwelling type: Bungalow, Detached
 Date of assessment: [REDACTED]
 Produced by: [REDACTED]
 Total floor area: 135 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.

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.14 W/m ² K	Very Good
Roof	Average thermal transmittance 0.15 W/m ² K	Very Good
Floor	Average thermal transmittance 0.09 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler and underfloor heating, electric	Poor
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	Room heaters, wood logs	
Hot water	Electric immersion, off-peak	Average
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 2.3 m ³ /h.m ² (assumed)	Very Good

Primary Energy use

The primary energy use for this property per year is 12 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling







The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **-0.6** per year

With the recommended measures the potential CO emissions could be: **-1.2** per year

Recommendations

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

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating	£75	 1	£75	 A 97
Photovoltaic		 -97	£103	 G 0
Wind turbine	£663	 115	£767	 A 114

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£103

Over a year you could save

£738

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details

Assessor name	Mr. Darryn Short
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	31/03/2023
Date of certificate	31/03/2023
Type of assessment	SAP, new dwelling