

Energy and Sustainability Report

Residential Development to provide two new dwellings
adjoining

21 Danesbury Park Road, Welwyn, AL6 9SH



Front Elevation (N.W.)



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PLANNING CONSULTANTS: DLA Town Planning Ltd

February 2026

Prepared by:



accredited SAP assessors

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BRIEF

Monitor Energy Consultancy has been instructed to undertake an Energy Report, to accompany the Planning application for this proposed development for two new detached residential dwellings. This report sets out how the proposals will meet the standards required of North Hertfordshire District Council's Local Plan 2022 Supplementary Planning Document to provide high quality sustainable design and demonstrates that the development will achieve better than the SPD Bronze level standard with on-site carbon reductions of **55.09%** compared with Building Regulations Part L 2021 and EPC ratings of Band B.

SITE LAYOUT AND KEY DESIGN FEATURES

The proposed design incorporates the following key features:

- South-facing fenestration to optimise solar gain with limited openings to the north.
- Better than current Building Regulations standards for insulation and ventilation are proposed.
- Low carbon air-source heat pumps as an alternative to gas boilers.

ESTABLISHING CO₂ EMISSIONS

This energy statement seeks to identify the carbon footprint for this development and to demonstrate that the requirements of the SPD Bronze standard have been met.

The Standard Case Target CO₂ Emission Rates (TER)s have been calculated using SAP 10.2 in accordance with Building Regulations Part L 2021 with the results detailed below.

Table 1 illustrates the CO₂ emissions for the regulated loads (for heating, hot water, pumps, fans and lighting) associated with each dwelling if built to comply with Building Regulations Part L 2021. The results calculated are tabulated below and a summary of the SAP calculations confirming the **TERs** can be found in **Appendix A**.

	Total Area GIA	Standard Case TER (CO ₂ kg/m ² /yr)	Total CO ₂ (kg/yr)
Plot A	269.5	6.40	1897.60
Plot B	269.5	6.36	1885.74
Total	539.0		3 783.34

Table 1: Standard (Building Regulations Compliant) Case SAP 10 results for all proposed new dwellings.

The total CO₂ emissions for the Building Regulations 2021 Compliant case has been calculated at 3 783.34 kg CO₂/yr.

DWELLING FABRIC EFFICIENCY MEASURES

In order to achieve the required target CO₂ emissions, a fabric first approach has been adopted, using enhanced standards of insulation for floor, walls windows and roof:

- U-Value for ground floors of 0.11 W/m²K using 150mm Celotex or similar PIR insulation compared to Building Regulations standard of 0.18 W/m²K,
- U-Value for cavity walls to Building Regulations standard of 0.18 W/m²K,
- U-Value for roof areas with flat ceilings of 0.11 W/m²K using 400mm mineral wool insulation compared to Building Regulations standard of 0.15 W/m²K,
- U-value for roof areas with sloping ceilings of 0.14 W/m²K using 100mm Kingspan K107 between rafters plus 60mm Kingspan K118 below, or similar, compared to Building Regulations standard of 0.15 W/m²K,
- High performing double-glazed doors windows and rooflights with low e glass and 16mm minimum gap, argon filled to achieve a maximum U-Value of 1.4 W/m²K compared to Building Regulations standard of 1.6 W/m²K,
- Hi-Therm insulated lintels and BRE approved thermal details eg Knauf, to be used for all junctions where applicable, to limit cold bridging at linear junctions with a calculated user defined psi values to achieve a maximum thermal bridging y value of 0.025 compared to standard default y value of 0.2,
- High levels of air tightness with a design air permeability rate of 5m³/hr/m³ at 50 Pa pressure compared to Building Regulations standard of 8m³/hr/m³

ADDITIONAL ENERGY EFFICIENCY MEASURES

- Mitsubishi Ecodan or similar air source heat pumps have been chosen for the heating system with time and temperature zone controls, to allow heating individual zones to be controlled separately, in order to reduce unnecessary energy use,
- Electric vehicle charging point to each plot,
- Water efficient sanitaryware, in particular dual flush WCs and flow restrictors to the showers and taps will be installed to reduce the demand for hot water, with calculations required to demonstrate a maximum of 110l of water use per person per day compared with Building Regulations Part G standard of 125l per person per day, water efficiency calculations can be found in **Appendix B**

- 100% Low energy lights with a minimum efficiency of 100 lumens per watt,
- Smart energy meters and monitoring.
- Overheating calculations will be carried out to ensure there will be no requirement for mechanical cooling.

The resulting Actual Case Dwelling Emission Rates (DER)s for the scheme as proposed have been calculated using SAP 10 in accordance with Building Regulations Part L 2021 with the results detailed below a summary of the SAP calculations confirming the **DERs** can be found in **Appendix A**.

	Total Area GIA	Actual Case DER (CO ₂ kg/m ² /yr)	Total CO ₂ (kg/yr)
Plot A	269.5	2.87	850.96
Plot B	269.5	2.86	847.99
	539.0		1 698.95

Table 2: Actual Case SAP 10 results for all new dwellings as proposed.

CONCLUSION

The total carbon emissions for the development as proposed are **1 698.95 kgCO₂/yr** compared to **3 783.34 CO₂/yr** for the Building Regulations 2021 Compliant case, a reduction of **55.09%**. Both dwellings have a SAP rating of 85B. The proposals therefore achieve the North Hertfordshire District Council's SPD Bronze standard.

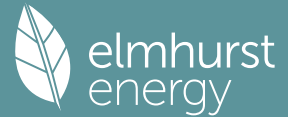
There is potential for the future developer to improve the proposed scheme by incorporating photovoltaic panels on the south east facing roof, or additional energy saving technologies such as mechanical ventilation with heat recovery (MVHR) and waste water heat recovery system (WWHR).

The SAP calculations are appended below with the **TER** and **TFEE** calculations indicating the Building Regulation compliant case and the **DER** and **DFEE** calculations indicating the dwellings as actually proposed. Full SAP calculations are available on request.

APPENDIX A

TER, DER, TFEE and DFEE CALCULATIONS

Full SAP Calculation Printout



Plot Reference	01	Issued on Date	12/02/2026
Assessment Reference	00001	Plot Type Ref	
Plot Address	Plot A, Adj 21, Danesbury Park Road, Welwyn, AL6 9SH	SAP Version	10.2
SAP Rating	85 B	DER	2.87
Environmental	97 A	% DER < TER	55.16
CO ₂ Emissions (t/year)	0.73	DFEE	34.67
Compliance Check	See BREL	% DFEE < TFEE	1.52
% DPER < TPER	12.56	DPER	29.69
		TPER	33.95
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (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	6 * 10 = 60.0000 (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) =	60.0000 / (5) = 0.0921 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3421 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2651 (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	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115 (22b)
Effective ac	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			43.3800	1.3258	57.5114		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Opening Type 3			2.8000	1.2357	3.4601		(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000 (28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000 (29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000 (29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000 (30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100 (30)
Total net area of external elements Aum(A, m ²)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496		(33)
Main dwelling							
Internal Wall 1			129.0000			75.0000	9675.0000 (32c)
Internal Wall 2			140.1100			9.0000	1260.9900 (32c)
Internal Floor 1			131.2000			18.0000	2361.6000 (30)
Internal Ceiling 1			138.3000			9.0000	1244.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	41037.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.2709 (35)
List of Thermal Bridges							

Full SAP Calculation Printout



K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0240	0.6984
E4 Jamb	57.0000	0.0190	1.0830
E5 Ground floor (normal)	54.4300	0.0410	2.2316
R1 Head of roof window	3.6000	0.2400	0.8640
R2 Sill of roof window	3.6000	0.2400	0.8640
R3 Jamb of roof window	9.3600	0.2400	2.2464
E6 Intermediate floor within a dwelling	54.4300	0.0200	1.0886
E10 Eaves (insulation at ceiling level)	13.2000	0.0240	0.3168
E11 Eaves (insulation at rafter level)	14.6000	0.0200	0.2920
E12 Gable (insulation at ceiling level)	27.4000	0.0450	1.2330
E13 Gable (insulation at rafter level)	2.6000	0.0550	0.1430
E16 Corner (normal)	40.8600	0.0400	1.6344
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0820	-1.6712
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.5241 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	137.3737 (37)

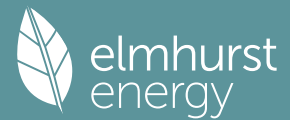
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	119.7774	119.3004	118.8329	116.6369	116.2261	114.3135	114.3135	113.9593	115.0502	116.2261	117.0572	117.9261	(38)
Heat transfer coeff	257.1511	256.6741	256.2066	254.0106	253.5998	251.6872	251.6872	251.3330	252.4239	253.5998	254.4309	255.2999	(39)
Average = Sum(39)m / 12 =												254.0087	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9542	0.9524	0.9507	0.9425	0.9410	0.9339	0.9339	0.9326	0.9366	0.9410	0.9441	0.9473	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	(42a)
Hot water usage for baths	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	(42b)
Hot water usage for other uses	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	(42c)
Average daily hot water use (litres/day)												145.9086	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Distribution loss (46)m = 0.15 x (45)m	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
12Total per year (kWh/year)												2964.2063	(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	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(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	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains	893.9941	919.8039	879.2568	853.9617	809.1198	778.6730	744.8458	747.7553	769.9857	795.9503	845.0732	874.5664	(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	

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Northeast			2.5200		11.2829		0.6300		0.7000		0.7700		8.6895 (75)
Southeast			26.5800		36.7938		0.6300		0.7000		0.7700		298.8834 (77)
Southwest			1.2600		36.7938		0.6300		0.7000		0.7700		14.1683 (79)
Northwest			13.0200		11.2829		0.6300		0.7000		0.7700		44.8957 (81)
Southeast			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Northwest			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)

Solar gains	395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052	(83)
Total gains	1289.5254	1622.1323	1912.0669	2247.4148	2468.8909	2468.6905	2356.7161	2155.3362	1927.2559	1591.9419	1324.1347	1209.5715	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501	
alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767	
util living area	0.9940	0.9849	0.9638	0.9025	0.7812	0.6063	0.4577	0.5152	0.7580	0.9427	0.9875	0.9953	(86)
Living	19.5505	19.7675	20.0691	20.4453	20.7263	20.8710	20.9100	20.9023	20.7945	20.4034	19.9049	19.5152	
Non living	18.3926	18.6703	19.0528	19.5224	19.8492	20.0022	20.0336	20.0302	19.9322	19.4811	18.8523	18.3519	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2585	19.7675	20.0691	20.4453	20.7263	20.8710	20.9100	20.9023	20.7945	20.4034	19.9049	19.7229	(87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275	(88)
util rest of house	0.9927	0.9818	0.9562	0.8823	0.7387	0.5385	0.3732	0.4272	0.6974	0.9266	0.9844	0.9943	(89)
MIT 2	19.4324	18.6703	19.0528	19.5224	19.8492	20.0022	20.0336	20.0302	19.9322	19.4811	18.8523	18.6718	(90)
Living area fraction									fLA =	Living area /	(4) =	0.0953	(91)
MIT	19.5111	18.7748	19.1496	19.6104	19.9327	20.0850	20.1171	20.1133	20.0143	19.5690	18.9526	18.7720	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5111	18.7748	19.1496	19.6104	19.9327	20.0850	20.1171	20.1133	20.0143	19.5690	18.9526	18.7720	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9753	0.9455	0.8680	0.7279	0.5340	0.3710	0.4244	0.6878	0.9133	0.9786	0.9922	(94)
Useful gains	1278.7511	1582.1119	1807.7810	1950.8308	1797.1476	1318.2985	874.3445	914.7602	1325.5413	1453.9628	1295.7584	1200.1720	(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	3911.5497	3561.3091	3240.9097	2720.5460	2087.8217	1380.4994	885.2194	933.2739	1492.9216	2274.5326	3015.6612	3720.2239	(97)
Space heating kWh	1958.8022	1330.0205	1066.2477	554.1949	216.2615	0.0000	0.0000	0.0000	0.0000	610.5039	1238.3300	1874.9186	(98a)
Space heating requirement - total per year (kWh/year)												8849.2794	
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	1958.8022	1330.0205	1066.2477	554.1949	216.2615	0.0000	0.0000	0.0000	0.0000	610.5039	1238.3300	1874.9186	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8849.2794	
Space heating per m2										(98c) / (4) =		32.8359	(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 %)													281.3248 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1958.8022	1330.0205	1066.2477	554.1949	216.2615	0.0000	0.0000	0.0000	0.0000	610.5039	1238.3300	1874.9186	(98)
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248	(210)
Space heating fuel (main heating system)	696.2777	472.7704	379.0095	196.9947	76.8725	0.0000	0.0000	0.0000	0.0000	217.0103	440.1780	666.4604	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
Efficiency of water heater	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	(216)
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

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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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											3145.5734	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											178.1926	
Water heating fuel used											1663.4845	(219)
Space cooling fuel											0.0000	(221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year											0.0000	(231)
Electricity for lighting (calculated in Appendix L)											332.8276	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											0.0000	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											5141.8855	(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	3145.5734	0.1558	490.0557 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.4845	0.1409	234.4080 (264)
Space and water heating			724.4638 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Total CO2, kg/year			772.5011 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8700 (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	3145.5734	1.5767	4959.7415 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.4845	1.5210	2530.2399 (278)
Space and water heating			7489.9814 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Total Primary energy kWh/year			8000.4835 (286)
Dwelling Primary energy Rate (DPER)			29.6900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

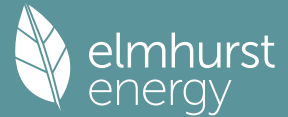
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0614 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3114 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2413 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
Effective ac	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836 (22b)
	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			43.3800	1.1450	49.6718		(27)
TER Roof Window			2.8000	1.1450	4.4569		(27a)
Heatloss Floor 1			138.3000	0.1300	17.9790		(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546		(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1800	0.0540		(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300		(30)
External Roof 2	19.8900	2.8000	17.0900	0.1100	1.8799		(30)
Total net area of external elements Aum(A, m2)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	119.5162	(33)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0500	1.4550
E4 Jamb	57.0000	0.0500	2.8500
E5 Ground floor (normal)	54.4300	0.1600	8.7088
R1 Head of roof window	3.6000	0.0800	0.2880
R2 Sill of roof window	3.6000	0.0600	0.2160
R3 Jamb of roof window	9.3600	0.0800	0.7488
E6 Intermediate floor within a dwelling	54.4300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	13.2000	0.0600	0.7920
E11 Eaves (insulation at rafter level)	14.6000	0.0400	0.5840
E12 Gable (insulation at ceiling level)	27.4000	0.0600	1.6440
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E16 Corner (normal)	40.8600	0.0900	3.6774
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0900	-1.8342

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

20.8378 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 140.3540 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	117.6717	117.2765	116.8891	115.0696	114.7292	113.1445	113.1445	112.8510	113.7549	114.7292	115.4179	116.1379 (38)
Heat transfer coeff	258.0257	257.6305	257.2431	255.4236	255.0832	253.4985	253.4985	253.2050	254.1089	255.0832	255.7719	256.4918 (39)
Average = Sum(39)m / 12 =												255.4220

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9574	0.9560	0.9545	0.9478	0.9465	0.9406	0.9406	0.9395	0.9429	0.9465	0.9491	0.9517 (40)
HLP (average)												0.9478
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

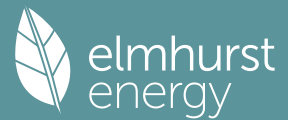
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0923 (42)
Hot water usage for mixer showers												
76.0673	74.9241	73.2583	70.0712	67.7191	65.0961	63.6052	65.2584	67.0706	69.8869	73.1425	75.7758 (42a)	
Hot water usage for baths												
32.8346	32.3470	31.6603	30.3941	29.4461	28.3948	27.8269	28.5088	29.2513	30.3762	31.6684	32.7236 (42b)	
Hot water usage for other uses												
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)	
Average daily hot water use (litres/day)												142.6635 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
155.1999	151.8856	147.8495	141.7126	136.7289	131.3711	129.3124	133.3310	137.5692	143.1940	149.4254	154.7975 (44)	
Energy content (annual)	245.7987	216.2830	227.2392	193.9975	184.0634	161.5361	156.3921	165.0916	169.6366	194.3129	212.8839	242.3754 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2369.6106
36.8698	32.4425	34.0859	29.0996	27.6095	24.2304	23.4588	24.7637	25.4455	29.1469	31.9326	36.3563 (46)	
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
292.3937	258.3688	273.8341	239.0894	230.6583	206.6280	202.9870	211.6865	214.7284	240.9078	257.9757	288.9703 (62)	
WWHRS	-34.7748	-30.7551	-32.2050	-26.6670	-24.8527	-21.2666	-19.9341	-21.1979	-22.0033	-25.9394	-29.3862	-34.1308 (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												
257.6189	227.6137	241.6292	212.4224	205.8057	185.3613	183.0529	190.4887	192.7252	214.9684	228.5895	254.8395 (64)	
12Total per year (kWh/year)												2595.1153 (64)
Electric shower(s)												2595 (64a)
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												
119.0040	105.5827	112.8330	100.5776	98.4770	89.7842	89.2763	92.1689	92.4776	101.8849	106.8574	117.8658 (65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	159.9516	157.1171	151.6572	139.6912	132.3616	124.7003	119.9950	123.8829	128.4412	136.9421	148.4130	158.4217	(72)
Total internal gains	889.8831	915.5936	874.7581	846.1660	800.9211	769.1400	737.8439	737.2379	760.6032	788.7302	838.1163	869.2450	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

Northeast					2.5200	11.2829	0.6300	0.7000			0.7700	8.6895 (75)	
Southeast					26.5800	36.7938	0.6300	0.7000			0.7700	298.8834 (77)	
Southwest					1.2600	36.7938	0.6300	0.7000			0.7700	14.1683 (79)	
Northwest					13.0200	11.2829	0.6300	0.7000			0.7700	44.8957 (81)	
Southeast					1.4000	26.0000	0.6300	0.7000			1.0000	14.4472 (82)	
Northwest					1.4000	26.0000	0.6300	0.7000			1.0000	14.4472 (82)	

Solar gains	395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052	(83)
Total gains	1285.4143	1617.9220	1907.5681	2239.6191	2460.6922	2459.1574	2349.7142	2144.8188	1917.8735	1584.7217	1317.1778	1204.2501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1784	44.2462	44.3128	44.6285	44.6880	44.9674	44.9674	45.0195	44.8594	44.6880	44.5677	44.4426
alpha	3.9452	3.9497	3.9542	3.9752	3.9792	3.9978	3.9978	4.0013	3.9906	3.9792	3.9712	3.9628
util living area	0.9940	0.9851	0.9642	0.9042	0.7843	0.6111	0.4617	0.5204	0.7623	0.9439	0.9877	0.9954 (86)
MIT	19.1617	19.4504	19.8525	20.3520	20.7309	20.9271	20.9814	20.9704	20.8226	20.2961	19.6297	19.1107 (87)
Th 2	20.1190	20.1202	20.1214	20.1271	20.1282	20.1331	20.1331	20.1340	20.1312	20.1282	20.1260	20.1238 (88)
util rest of house	0.9928	0.9820	0.9567	0.8842	0.7420	0.5427	0.3761	0.4314	0.7017	0.9280	0.9847	0.9944 (89)
MIT 2	17.9357	18.3044	18.8138	19.4346	19.8751	20.0800	20.1239	20.1182	19.9852	19.3789	18.5389	17.8737 (90)
Living area fraction	fLA = Living area / (4) = 0.0953 (91)											
MIT	18.0526	18.4136	18.9128	19.5220	19.9567	20.1607	20.2056	20.1994	20.0650	19.4663	18.6429	17.9916 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.0526	18.4136	18.9128	19.5220	19.9567	20.1607	20.2056	20.1994	20.0650	19.4663	18.6429	17.9916 (93)

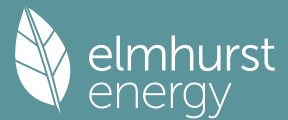
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9735	0.9431	0.8676	0.7328	0.5450	0.3835	0.4383	0.6966	0.9124	0.9771	0.9907	(94)
Useful gains	1270.3928	1574.9766	1798.9511	1943.0557	1803.0839	1340.3020	901.0804	940.1742	1335.9151	1445.9189	1287.0492	1193.0930	(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	3548.5118	3481.5156	3193.0966	2713.1128	2106.1381	1409.6267	914.0083	962.0203	1515.7642	2261.6483	2952.3453	3537.4342	(97)
Space heating kWh	1694.9206	1281.1942	1037.2442	554.4411	225.4724	0.0000	0.0000	0.0000	0.0000	606.9027	1199.0133	1744.1898	(98a)
Space heating requirement - total per year (kWh/year)													8343.3782
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	1694.9206	1281.1942	1037.2442	554.4411	225.4724	0.0000	0.0000	0.0000	0.0000	606.9027	1199.0133	1744.1898	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													8343.3782
Space heating per m2													(98c) / (4) = 30.9587 (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	1694.9206	1281.1942	1037.2442	554.4411	225.4724	0.0000	0.0000	0.0000	0.0000	606.9027	1199.0133	1744.1898	(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)	1836.3170	1388.0760	1123.7749	600.6945	244.2821	0.0000	0.0000	0.0000	0.0000	657.5328	1299.0393	1889.6964	(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	257.6189	227.6137	241.6292	212.4224	205.8057	185.3613	183.0529	190.4887	192.7252	214.9684	228.5895	254.8395	(64)	
Efficiency of water heater													79.8000	(216)

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(217)m	87.4980	87.3144	86.9472	86.1099	84.2649	79.8000	79.8000	79.8000	79.8000	86.2555	87.2248	87.5414	(217)
Fuel for water heating, kWh/month	294.4283	260.6827	277.9032	246.6876	244.2365	232.2824	229.3897	238.7076	241.5103	249.2227	262.0693	291.1076	(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	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	46.6419	37.4179	33.6906	24.6832	19.0660	15.5771	17.3927	22.6076	29.3651	38.5286	43.5179	47.9382	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-109.5638	-145.3587	-196.6309	-207.4344	-212.5216	-194.1360	-191.3056	-185.6103	-174.6022	-158.9617	-116.9652	-95.7883	(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	-92.9346	-190.8548	-371.2829	-546.5813	-712.6148	-712.7430	-704.7246	-601.5630	-447.2755	-269.5853	-122.8963	-73.8892	(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												9039.4130	(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												3068.2279	(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)												376.4268	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6835.8240	(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												5734.2437	(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	9039.4130	0.2100	1898.2767 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3068.2279	0.2100	644.3279 (264)
Space and water heating			2542.6046 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	376.4268	0.1443	54.3300 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.8787	0.1360	-270.4319
PV Unit electricity exported	-4846.9453	0.1265	-613.0659
Total			-883.4977 (269)
Total CO2, kg/year			1725.3661 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.4000 (273)

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

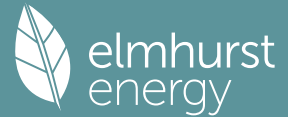
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	9039.4130	1.1300	10214.5367 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3068.2279	1.1300	3467.0975 (278)
Space and water heating			13681.6342 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	376.4268	1.5338	577.3760 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.8787	1.5026	-2988.5005
PV Unit electricity exported	-4846.9453	0.4643	-2250.4950
Total			-5238.9955 (283)
Total Primary energy kWh/year			9150.1155 (286)
Target Primary Energy Rate (TPER)			33.9500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (5)

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2. Ventilation rate

											m3 per hour			
Number of open chimneys												0 * 80 =	0.0000 (6a)	
Number of open flues												0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)	
Number of blocked chimneys												0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
													Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.0614 (8)	
Pressure test												Yes		
Pressure Test Method												Blower Door		
Measured/design AP50												5.0000 (17)		
Infiltration rate												0.3114 (18)		
Number of sides sheltered												3 (19)		
													(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Shelter factor												(21) = (18) x (20) =	0.2413 (21)	
Infiltration rate adjusted to include shelter factor														
	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	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836 (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	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402 (25)		

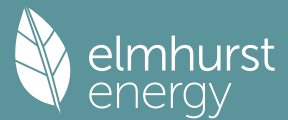
3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m2)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		124.8496			(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		41037.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2709	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				30.0000	0.0500	1.5000		
E3 Sill				29.1000	0.0240	0.6984		
E4 Jamb				57.0000	0.0190	1.0830		
E5 Ground floor (normal)				54.4300	0.0410	2.2316		
R1 Head of roof window				3.6000	0.2400	0.8640		
R2 Sill of roof window				3.6000	0.2400	0.8640		
R3 Jamb of roof window				9.3600	0.2400	2.2464		
E6 Intermediate floor within a dwelling				54.4300	0.0200	1.0886		
E10 Eaves (insulation at ceiling level)				13.2000	0.0240	0.3168		
E11 Eaves (insulation at rafter level)				14.6000	0.0200	0.2920		
E12 Gable (insulation at ceiling level)				27.4000	0.0450	1.2330		
E13 Gable (insulation at rafter level)				2.6000	0.0550	0.1430		
E16 Corner (normal)				40.8600	0.0400	1.6344		
E17 Corner (inverted - internal area greater than external area)				20.3800	-0.0820	-1.6712		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5241	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		137.3737	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0923 (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	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772 (42b)
Hot water usage for other uses	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)
Average daily hot water use (litres/day)												71.8559 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	78.4007	76.2325	73.8596	71.1436	68.5295	65.5651	64.5933	67.4652	69.7724	72.7251	75.7282	78.3752 (44)
Energy content (annual)	115.4194	100.8711	105.5438	92.9313	88.3072	75.8239	71.3775	79.4078	80.9325	93.7137	102.3492	115.0998 (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 (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (62)
Total heat required for water heating calculated for each month	98.1065	85.7404	89.7122	78.9916	75.0612	64.4503	60.6709	67.4966	68.7926	79.6566	86.9968	97.8348 (64)
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	98.1065	85.7404	89.7122	78.9916	75.0612	64.4503	60.6709	67.4966	68.7926	79.6566	86.9968	97.8348 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											953.5105 (64)
Electric shower(s)	60.9172	54.2777	59.2692	56.5599	57.6212	54.9650	56.7972	57.6212	56.5599	59.2692	58.1547	60.9172 (64a)
Heat gains from water heating, kWh/month	39.7559	35.0045	37.2454	33.8879	33.1706	29.8538	29.3670	31.2795	31.3381	34.7314	36.2879	39.6880 (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	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	53.4354	52.0901	50.0610	47.0665	44.5841	41.4636	39.4718	42.0423	43.5252	46.6821	50.3998	53.3441	(72)
Total internal gains	780.3668	807.5666	770.1618	750.5413	710.1437	685.9033	657.3207	655.3973	675.6872	695.4701	737.1032	761.1673	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					2.5200	11.2829		0.6300	0.7000	0.7700		8.6895 (75)	
Southeast					26.5800	36.7938		0.6300	0.7000	0.7700		298.8834 (77)	
Southwest					1.2600	36.7938		0.6300	0.7000	0.7700		14.1683 (79)	
Northwest					13.0200	11.2829		0.6300	0.7000	0.7700		44.8957 (81)	
Southeast					1.4000	26.0000		0.6300	0.7000	1.0000		14.4472 (82)	
Northwest					1.4000	26.0000		0.6300	0.7000	1.0000		14.4472 (82)	
Solar gains		395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052 (83)
Total gains		1175.8981	1509.8950	1802.9719	2143.9944	2369.9148	2375.9208	2269.1910	2062.9781	1832.9575	1491.4617	1216.1646	1096.1725 (84)

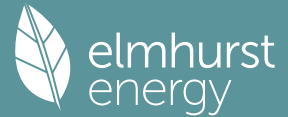
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.6947	44.7640	44.8322	45.1553	45.2163	45.5024	45.5024	45.5557	45.3918	45.2163	45.0931	44.9651
alpha	3.9796	3.9843	3.9888	4.0104	4.0144	4.0335	4.0335	4.0370	4.0261	4.0144	4.0062	3.9977
util living area	0.9957	0.9881	0.9697	0.9132	0.7962	0.6227	0.4718	0.5332	0.7779	0.9524	0.9906	0.9967 (86)
MIT	19.1212	19.4129	19.8198	20.3310	20.7208	20.9243	20.9807	20.9689	20.8126	20.2669	19.5921	19.0708 (87)
Th 2	20.1283	20.1295	20.1307	20.1364	20.1375	20.1424	20.1424	20.1434	20.1405	20.1375	20.1353	20.1331 (88)
util rest of house	0.9948	0.9856	0.9632	0.8946	0.7551	0.5546	0.3856	0.4436	0.7191	0.9386	0.9883	0.9960 (89)
MIT 2	18.3841	18.6750	19.0780	19.5762	19.9316	20.0991	20.1349	20.1302	20.0190	19.5245	18.8590	18.3373 (90)
Living area fraction	18.4543	18.7453	19.1487	19.6481	20.0068	20.1778	20.2155	20.2101	20.0946	19.5953	18.9288	18.4072 (91)
MIT	18.4543	18.7453	19.1487	19.6481	20.0068	20.1778	20.2155	20.2101	20.0946	19.5953	18.9288	18.4072 (92)
Temperature adjustment	18.4543	18.7453	19.1487	19.6481	20.0068	20.1778	20.2155	20.2101	20.0946	19.5953	18.9288	18.4072 (93)
adjusted MIT	18.4543	18.7453	19.1487	19.6481	20.0068	20.1778	20.2155	20.2101	20.0946	19.5953	18.9288	18.4072 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9922	0.9802	0.9537	0.8822	0.7483	0.5575	0.3932	0.4509	0.7156	0.9275	0.9837	0.9940	(94)
Ext temp.	1166.7317	1480.0324	1719.5652	1891.4259	1773.3162	1324.6679	892.2151	930.1806	1311.5808	1383.2801	1196.3120	1089.5943	(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	3610.0020	3525.7203	3216.0857	2713.2856	2094.1583	1397.3331	905.7433	953.3869	1505.4245	2267.7288	2990.2254	3601.6802	(97)
Space heating requirement - total per year (kWh/year)	1817.7931	1374.7023	1113.4113	591.7390	238.7065	0.0000	0.0000	0.0000	0.0000	658.0298	1291.6176	1868.9919	(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)

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Solar heating contribution - total per year (kWh/year) 0.0000
 Space heating kWh
 1817.7931 1374.7023 1113.4113 591.7390 238.7065 0.0000 0.0000 0.0000 0.0000 658.0298 1291.6176 1868.9919 (98c)
 Space heating requirement after solar contribution - total per year (kWh/year) 8954.9916
 Space heating per m2 (98c) / (4) = 33.2282 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2354.8709	1853.8345	1901.7078	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8429	0.9017	0.8669	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1984.9238	1671.6306	1648.6752	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	464.0944	624.7087	470.2587	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	116.0236	156.1772	117.5647	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												389.7654 (107)
Energy for space cooling												33.2282 (99)
Total												1.4463 (108)
Fabric Energy Efficiency (DFEE)												34.6744 (109)
												34.7 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

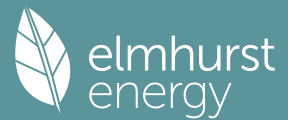
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0614 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3114 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2413 (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	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836 (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	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			43.3800	1.1450	49.6718		(27)
TER Roof Window			2.8000	1.1450	4.4569		(27a)
Heatloss Floor 1			138.3000	0.1300	17.9790		(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546		(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1800	0.0540		(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300		(30)
External Roof 2	19.8900	2.8000	17.0900	0.1100	1.8799		(30)
Total net area of external elements Aum(A, m2)			493.7300				(31)

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Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 119.5162 (33)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0500	1.4550
E4 Jamb	57.0000	0.0500	2.8500
E5 Ground floor (normal)	54.4300	0.1600	8.7088
R1 Head of roof window	3.6000	0.0800	0.2880
R2 Sill of roof window	3.6000	0.0600	0.2160
R3 Jamb of roof window	9.3600	0.0800	0.7488
E6 Intermediate floor within a dwelling	54.4300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	13.2000	0.0600	0.7920
E11 Eaves (insulation at rafter level)	14.6000	0.0400	0.5840
E12 Gable (insulation at ceiling level)	27.4000	0.0600	1.6440
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E16 Corner (normal)	40.8600	0.0900	3.6774
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0900	-1.8342

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

20.8378 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 140.3540 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	117.6717	117.2765	116.8891	115.0696	114.7292	113.1445	113.1445	112.8510	113.7549	114.7292	115.4179	116.1379	(38)
Heat transfer coeff	258.0257	257.6305	257.2431	255.4236	255.0832	253.4985	253.4985	253.2050	254.1089	255.0832	255.7719	256.4918	(39)
Average = Sum(39)m / 12 =												255.4220	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9574	0.9560	0.9545	0.9478	0.9465	0.9406	0.9406	0.9395	0.9429	0.9465	0.9491	0.9517	(40)
HLP (average)												0.9478	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

3.0923 (42)

Hot water usage for mixer showers

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths

32.8346 32.3470 31.6603 30.3941 29.4461 28.3948 27.8269 28.5088 29.2513 30.3762 31.6684 32.7236 (42b)

Hot water usage for other uses

46.2980 44.6145 42.9309 41.2473 39.5638 37.8802 37.8802 39.5638 41.2473 42.9309 44.6145 46.2980 (42c)

Average daily hot water use (litres/day)

72.5320 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.1327	76.9615	74.5912	71.6415	69.0098	66.2750	65.7072	68.0726	70.4986	73.3071	76.2829	79.0217	(44)
Energy conte	125.3268	109.5921	114.6439	98.0736	92.9005	81.4928	79.4671	84.2881	86.9319	99.4771	108.6790	123.7288	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
0.0000 0.0000													
Water storage loss (or HIU loss):													
Total storage loss													
0.0000 0.0000 0.0000													
If cylinder contains dedicated solar storage													
0.0000 0.0000 0.0000													
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													
106.5278 93.1533 97.4473 83.3626 78.9654 69.2689 67.5470 71.6449 73.8921 84.5555 92.3771 105.1695													(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													
106.5278 93.1533 97.4473 83.3626 78.9654 69.2689 67.5470 71.6449 73.8921 84.5555 92.3771 105.1695													(64)
Total per year (kWh/year)													
1023.9115													(64)
1024													(64)

Electric shower(s)

60.9172 54.2777 59.2692 56.5599 57.6212 54.9650 56.7972 57.6212 56.5599 59.2692 58.1547 60.9172 (64a)

Heat gains from water heating, kWh/month

41.8612 36.8578 39.1791 34.9806 34.1467 31.0585 31.0861 32.3165 32.6130 35.9562 37.6330 41.5217 (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	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)

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

224.4770 248.5282 224.4770 231.9596 224.4770 231.9596 224.4770 224.4770 231.9596 224.4770 231.9596 224.4770 (67)

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

433.0702 437.5641 426.2396 402.1310 371.6983 343.0959 323.9877 319.4937 330.8183 354.9268 385.3595 413.9620 (68)

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

38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 (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)

-123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 (71)

Water heating gains (Table 5)

56.2651 54.8478 52.6601 48.5842 45.8960 43.1368 41.7823 43.4362 45.2958 48.3282 52.2680 55.8087 (72)

Total internal gains

783.1966 810.3243 772.7610 752.0590 711.4556 687.5765 659.6312 656.7912 677.4579 697.1162 738.9713 763.6319 (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

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Northeast	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (75)
Southeast	26.5800	36.7938	0.6300	0.7000	0.7700	298.8834 (77)
Southwest	1.2600	36.7938	0.6300	0.7000	0.7700	14.1683 (79)
Northwest	13.0200	11.2829	0.6300	0.7000	0.7700	44.8957 (81)
Southeast	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)
Northwest	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)

Solar gains	395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052 (83)
Total gains	1178.7278	1512.6528	1805.5710	2145.5121	2371.2267	2377.5939	2271.5015	2064.3721	1834.7281	1493.1078	1218.0328	1098.6371 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1784	44.2462	44.3128	44.6285	44.6880	44.9674	44.9674	45.0195	44.8594	44.6880	44.5677	44.4426
alpha	3.9452	3.9497	3.9542	3.9752	3.9792	3.9978	3.9978	4.0013	3.9906	3.9792	3.9712	3.9628
util living area	0.9956	0.9881	0.9699	0.9144	0.7993	0.6272	0.4761	0.5378	0.7811	0.9529	0.9906	0.9967 (86)
MIT	19.0985	19.3903	19.7990	20.3136	20.7099	20.9200	20.9793	20.9668	20.8050	20.2518	19.5724	19.0477 (87)
Th 2	20.1190	20.1202	20.1214	20.1271	20.1282	20.1331	20.1331	20.1340	20.1312	20.1282	20.1260	20.1238 (88)
util rest of house	0.9947	0.9856	0.9634	0.8960	0.7582	0.5583	0.3885	0.4469	0.7221	0.9391	0.9883	0.9960 (89)
MIT 2	18.3547	18.6457	19.0505	19.5522	19.9141	20.0873	20.1250	20.1200	20.0047	19.5027	18.8325	18.3075 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.4255	18.7167	19.1218	19.6248	19.9899	20.1667	20.2064	20.2007	20.0810	19.5741	18.9030	18.3781 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4255	18.7167	19.1218	19.6248	19.9899	20.1667	20.2064	20.2007	20.0810	19.5741	18.9030	18.3781 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9921	0.9801	0.9539	0.8833	0.7510	0.5612	0.3961	0.4542	0.7183	0.9279	0.9836	0.9939 (94)
Useful gains	1169.4122	1482.6056	1722.2840	1895.2163	1780.8261	1334.2136	899.7067	937.5732	1317.8735	1385.4690	1198.0481	1091.9420 (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	3644.7549	3559.6000	3246.8655	2739.3617	2114.6170	1411.1452	914.2225	962.3562	1519.8212	2289.1300	3018.8751	3636.5606 (97)
Space heating kWh	1841.6550	1395.7402	1134.2886	607.7847	248.3405	0.0000	0.0000	0.0000	0.0000	672.3237	1310.9955	1893.1962 (98a)
Space heating requirement - total per year (kWh/year)	9104.3243											
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	1841.6550	1395.7402	1134.2886	607.7847	248.3405	0.0000	0.0000	0.0000	0.0000	672.3237	1310.9955	1893.1962 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	9104.3243											
Space heating per m2	(98c) / (4) = 33.7823 (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	2382.8855	1875.8886	1924.3579	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8375	0.8975	0.8619	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1995.6076	1683.6265	1658.5997	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2631.1726	2513.6032	2282.1373	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000										
			0.0000	0.0000	0.0000	457.6068	617.5027	463.9120	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)												1.0000 (105)
	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	114.4017	154.3757	115.9780	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	384.7554 (107)											
Energy for space heating	33.7823 (99)											
Energy for space cooling	1.4277 (108)											
Total	35.2099 (109)											
Fabric Energy Efficiency (TFEE)	35.2 (109)											

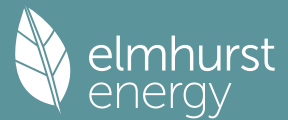
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (5)

2. Ventilation rate

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											m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												6 * 10 =	60.0000 (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) =											60.0000 / (5) =	0.0921 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000	(17)
Infiltration rate												0.3421	(18)
Number of sides sheltered												3	(19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2651 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115 (22b)	
Effective ac	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485 (25)	

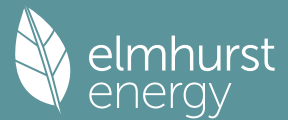
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m2)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496			(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		41037.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2709	(35)
List of Thermal Bridges								
K1 Element					Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)					30.0000	0.0500	1.5000	
E3 Sill					29.1000	0.0240	0.6984	
E4 Jamb					57.0000	0.0190	1.0830	
E5 Ground floor (normal)					54.4300	0.0410	2.2316	
R1 Head of roof window					3.6000	0.2400	0.8640	
R2 Sill of roof window					3.6000	0.2400	0.8640	
R3 Jamb of roof window					9.3600	0.2400	2.2464	
E6 Intermediate floor within a dwelling					54.4300	0.0200	1.0886	
E10 Eaves (insulation at ceiling level)					13.2000	0.0240	0.3168	
E11 Eaves (insulation at rafter level)					14.6000	0.0200	0.2920	
E12 Gable (insulation at ceiling level)					27.4000	0.0450	1.2330	
E13 Gable (insulation at rafter level)					2.6000	0.0550	0.1430	
E16 Corner (normal)					40.8600	0.0400	1.6344	
E17 Corner (inverted - internal area greater than external area)					20.3800	-0.0820	-1.6712	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.5241 (36)
Point Thermal bridges							(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =		137.3737 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0923 (42)
Hot water usage for mixer showers												
80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518 (42a)	
Hot water usage for baths												
32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772 (42b)	
Hot water usage for other uses												
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)	
Average daily hot water use (litres/day)												145.9086 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270 (44)	
Energy conte	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554 (45)
Energy content (annual)	Total = Sum(45)m =											2278.3713
Distribution loss (46)m = 0.15 x (45)m												
35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433 (46)	

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Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
Total per year (kWh/year) = Sum(64)m =												2964.2063 (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												
124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(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	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460 (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)												
	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912 (71)
Water heating gains (Table 5)												
	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431 (72)
Total internal gains												
	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast		2.5200		11.2829		0.6300		0.7000		0.7700		8.6895 (75)
Southeast		26.5800		36.7938		0.6300		0.7000		0.7700		298.8834 (77)
Southwest		1.2600		36.7938		0.6300		0.7000		0.7700		14.1683 (79)
Northwest		13.0200		11.2829		0.6300		0.7000		0.7700		44.8957 (81)
Southeast		1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Northwest		1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Solar gains	395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052 (83)
Total gains	1374.5742	1680.0755	1980.6686	2288.3919	2495.8560	2471.0854	2358.4915	2160.1661	1937.9959	1630.3064	1376.5112	1286.5182 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501
alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767
util living area												
	0.9925	0.9830	0.9597	0.8979	0.7766	0.6059	0.4573	0.5142	0.7556	0.9386	0.9857	0.9942 (86)
Living	19.5880	19.7921	20.0955	20.4573	20.7308	20.8711	20.9100	20.9025	20.7961	20.4168	19.9274	19.5494
Non living	18.4405	18.7013	19.0855	19.5365	19.8537	20.0023	20.0337	20.0303	19.9336	19.4972	18.8807	18.3956
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2777	19.7921	20.0955	20.4573	20.7308	20.8711	20.9100	20.9025	20.7961	20.4168	19.9274	19.7523 (87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275 (88)
util rest of house												
	0.9909	0.9795	0.9514	0.8770	0.7339	0.5380	0.3729	0.4264	0.6948	0.9216	0.9822	0.9929 (89)
MIT 2	19.4515	18.7013	19.0855	19.5365	19.8537	20.0023	20.0337	20.0303	19.9336	19.4972	18.8807	18.7077 (90)
Living area fraction												fLA = Living area / (4) =
												0.0953 (91)
MIT	19.5302	18.8053	19.1817	19.6242	19.9373	20.0851	20.1172	20.1134	20.0158	19.5848	18.9805	18.8072 (92)
Temperature adjustment												
adjusted MIT	19.5302	18.8053	19.1817	19.6242	19.9373	20.0851	20.1172	20.1134	20.0158	19.5848	18.9805	18.8072 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9896	0.9726	0.9400	0.8627	0.7232	0.5336	0.3707	0.4235	0.6853	0.9081	0.9759	0.9904 (94)
Useful gains	1360.3079	1634.0082	1861.9161	1974.2328	1805.0679	1318.5050	874.3772	914.9185	1328.0833	1480.4814	1343.2795	1274.2206 (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												
	3916.4593	3569.1205	3249.1376	2724.0700	2088.9702	1380.5281	885.2241	933.2964	1493.2880	2278.5483	3022.7554	3729.2220 (97)
Space heating kWh												
	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210 (98a)
Space heating requirement - total per year (kWh/year)												8614.8766

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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	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8614.8766
Space heating per m2										(98c) / (4) =		31.9661 (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 %)												281.3248 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210 (98)
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248 (210)
Space heating fuel (main heating system)	676.0074	462.2398	366.8687	191.9073	75.0817	0.0000	0.0000	0.0000	0.0000	211.0591	429.8315	649.2569 (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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater (217)m	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926 (216)
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3062.2524 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1926
Water heating fuel used												1663.4845 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5058.5645 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3062.2524	16.4900	504.9654 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.4845	16.4900	274.3086 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	16.4900	54.8833 (250)
Additional standing charges			0.0000 (251)
Total energy cost			834.1573 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9548 (257)
SAP value		84.5221
SAP rating (Section 12)		85 (258)
SAP band		B

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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	3062.2524	0.1558	477.0695 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.4845	0.1409	234.4080 (264)
Space and water heating			711.4775 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Total CO2, kg/year			759.5148 (272)
CO2 emissions per m2			2.8200 (273)
EI value			96.7639
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (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) =	60.0000 / (5) = 0.0921 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3421 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2651 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.2983	0.2850	0.2916	0.2585	0.2585	0.2254	0.2320	0.2254	0.2386	0.2585	0.2519	0.2718 (22b)
Effective ac	0.5445	0.5406	0.5425	0.5334	0.5334	0.5254	0.5269	0.5254	0.5285	0.5334	0.5317	0.5369 (25)

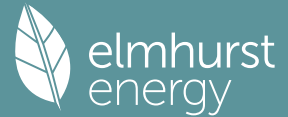
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			43.3800	1.3258	57.5114		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Opening Type 3			2.8000	1.2357	3.4601		(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000 (28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000 (29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000 (29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000 (30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100 (30)
Total net area of external elements Aum(A, m2)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496		(33)
Main dwelling							
Internal Wall 1			129.0000			75.0000	9675.0000 (32c)
Internal Wall 2			140.1100			9.0000	1260.9900 (32c)
Internal Floor 1			131.2000			18.0000	2361.6000 (32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 41037.0000 (34)
152.2709 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	30.0000	0.0500	1.5000
E2 Other lintels (including other steel lintels)	29.1000	0.0240	0.6984
E3 Sill	57.0000	0.0190	1.0830
E4 Jamb	54.4300	0.0410	2.2316
E5 Ground floor (normal)	3.6000	0.2400	0.8640
R1 Head of roof window	3.6000	0.2400	0.8640
R2 Sill of roof window			

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R3 Jamb of roof window						9.3600	0.2400	2.2464					
E6 Intermediate floor within a dwelling						54.4300	0.0200	1.0886					
E10 Eaves (insulation at ceiling level)						13.2000	0.0240	0.3168					
E11 Eaves (insulation at rafter level)						14.6000	0.0200	0.2920					
E12 Gable (insulation at ceiling level)						27.4000	0.0450	1.2330					
E13 Gable (insulation at rafter level)						2.6000	0.0550	0.1430					
E16 Corner (normal)						40.8600	0.0400	1.6344					
E17 Corner (inverted - internal area greater than external area)						20.3800	-0.0820	-1.6712					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												12.5241	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	137.3737 (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	117.0572	116.2261	116.6369	114.6771	114.6771	112.9534	113.2792	112.9534	113.6145	114.6771	114.3135	115.4327	(38)
Average = Sum(39)m / 12 =	254.4309	253.5998	254.0106	252.0508	252.0508	250.3271	250.6529	250.3271	250.9882	252.0508	251.6872	252.8064	(39)
												252.0819	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9441	0.9410	0.9425	0.9353	0.9353	0.9289	0.9301	0.9289	0.9313	0.9353	0.9339	0.9381	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	
												0.9354	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers													
	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	(42a)
Hot water usage for baths													
	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	(42b)
Hot water usage for other uses													
	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	(42c)
Average daily hot water use (litres/day)												145.9086	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Distribution loss (46)m = 0.15 x (45)m													
	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss													
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage													
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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													
	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
												2964.2063	(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)
												0.0000	(64a)
Heat gains from water heating, kWh/month													
	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(65)

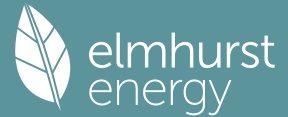
5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	(66)
	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	(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)													
	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)													
	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains													
	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131	(73)

6. Solar gains													

[Jan]													
	Area												
	m2												
	Solar flux												
	Table 6a												
	W/m2												
	Specific data												
	or Table 6b												
	Specific data												
	or Table 6c												
	Access												
	factor												
	Table 6d												
	Gains												
	W												
Northeast	2.5200												9.9600 (75)
Southeast	26.5800												330.4058 (77)
Southwest	1.2600												15.6626 (79)
Northwest	13.0200												51.4598 (81)
Southeast	1.4000												16.6698 (82)
Northwest	1.4000												16.6698 (82)

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Solar gains	440.8277	718.0778	1048.9991	1443.9948	1686.3668	1837.2534	1716.9334	1512.7429	1250.5400	854.5993	547.2114	369.6359 (83)
Total gains	1419.8706	1695.8248	1996.8577	2338.9337	2522.4517	2618.3213	2463.5546	2265.3282	2031.2656	1688.9142	1444.6612	1321.1490 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.8026	44.9494	44.8767	45.2257	45.2257	45.5371	45.4779	45.5371	45.4171	45.2257	45.2910	45.0905
alpha	3.9868	3.9966	3.9918	4.0150	4.0150	4.0358	4.0319	4.0358	4.0278	4.0150	4.0194	4.0060
util living area	0.9912	0.9820	0.9546	0.8788	0.7410	0.5225	0.3622	0.4022	0.6906	0.9215	0.9817	0.9932 (86)
Living	19.6485	19.8296	20.1575	20.5257	20.7750	20.8965	20.9188	20.9166	20.8416	20.4934	20.0054	19.6154
Non living	18.5241	18.7563	19.1686	19.6231	19.9055	20.0274	20.0420	20.0422	19.9811	19.5938	18.9861	18.4858
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3086	19.8296	20.1575	20.5257	20.7750	20.8965	20.9188	20.9166	20.8416	20.4934	20.0054	19.8091 (87)
Th 2	20.1302	20.1328	20.1315	20.1376	20.1376	20.1430	20.1420	20.1430	20.1410	20.1376	20.1388	20.1353 (88)
util rest of house	0.9893	0.9783	0.9451	0.8544	0.6931	0.4517	0.2778	0.3121	0.6208	0.8999	0.9773	0.9917 (89)
MIT 2	19.4899	18.7563	19.1686	19.6231	19.9055	20.0274	20.0420	20.0422	19.9811	19.5938	18.9861	18.7830 (90)
Living area fraction	19.5679	18.8586	19.2628	19.7091	19.9883	20.1102	20.1256	20.1255	20.0631	19.6795	19.0832	18.8808 (92)
MIT	19.5679	18.8586	19.2628	19.7091	19.9883	20.1102	20.1256	20.1255	20.0631	19.6795	19.0832	18.8808 (93)
Temperature adjustment												0.0000
adjusted MIT	19.5679	18.8586	19.2628	19.7091	19.9883	20.1102	20.1256	20.1255	20.0631	19.6795	19.0832	18.8808 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9879	0.9711	0.9333	0.8403	0.6840	0.4489	0.2762	0.3103	0.6139	0.8857	0.9699	0.9889 (94)
Useful gains	1402.7074	1646.8540	1863.6357	1965.5208	1725.4070	1175.2520	680.3703	702.8506	1246.9854	1495.9430	1401.2049	1306.4787 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	3833.7417	3514.5289	3140.2905	2598.4239	1937.8544	1204.1219	683.1777	707.2976	1346.0700	2162.4637	2940.5113	3635.5543 (97)
Space heating kWh	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322 (98a)
Space heating requirement - total per year (kWh/year)												7964.3736
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	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7964.3736
Space heating per m2										(98c) / (4) =		29.5524 (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 %)												280.7686 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322 (98)
Space heating efficiency (main heating system 1)	280.7686	280.7686	280.7686	280.7686	280.7686	0.0000	0.0000	0.0000	0.0000	280.7686	280.7686	280.7686 (210)
Space heating fuel (main heating system)	644.1922	447.0149	338.2968	162.3010	56.2958	0.0000	0.0000	0.0000	0.0000	176.6192	394.7381	617.1745 (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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater (217)m	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889 (216)
Fuel for water heating, kWh/month	163.8259	144.8693	153.8970	138.3977	134.3129	118.6458	113.5135	122.8103	123.0088	138.8361	147.9774	163.4246 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2836.6324 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1889
Water heating fuel used												1663.5193 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4832.9793 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2836.6324	28.4300	806.4546 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	28.4300	472.9385 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	28.4300	94.6229 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1374.0160 (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	2836.6324	0.1562	443.1503 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.5193	0.1409	234.4130 (264)
Space and water heating			677.5633 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Total CO2, kg/year			725.6006 (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	2836.6324	1.5783	4477.1574 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	1.5210	2530.2928 (278)
Space and water heating			7007.4502 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Total Primary energy kWh/year			7517.9523 (286)

SAP 10 EPC IMPROVEMENTS

00001

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

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.2	-£ 306	-144 kg (19.9%)

Measures omitted - SAP change or cost saving too small:	
N Solar water heating	+ 0.9 -£ 91 -39 kg (5.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£306	0.54 kg/m²	B 88	A 97
Total Savings	£306	0.54 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 590 TEST (30 Jan 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1374	£1374	£0
Space heating	£806	£806	£0
Water heating	£473	£473	£0
Lighting	£95	£95	£0
Generated (PV)	-£0	-£306	£306
Total cost of fuels	£1374	£1068	£306
Total cost of uses	£1374	£1068	£306
Delivered energy	18 kWh/m²	14 kWh/m²	4 kWh/m²

Full SAP Calculation Printout



Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.1 tonnes
CO2 emissions per m ²	3 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	28 kWh/m ²	22 kWh/m ²	6 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)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

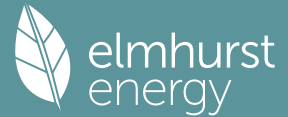
2. Ventilation rate

	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	6 * 10 = 60.0000 (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) =	60.0000 / (5) = 0.0921 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3421 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2651 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.3380 0.3314 0.3248 0.2916 0.2850 0.2519 0.2519 0.2452 0.2651 0.2850 0.2983 0.3115 (22b)
Effective ac	0.5571 0.5549 0.5527 0.5425 0.5406 0.5317 0.5317 0.5301 0.5351 0.5406 0.5445 0.5485 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			43.3800	1.3258	57.5114		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Opening Type 3			2.8000	1.2357	3.4601		(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000 (28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000 (29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000 (29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000 (30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100 (30)
Total net area of external elements Aum(A, m ²)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		124.8496		(33)
Main dwelling							
Internal Wall 1			129.0000			75.0000	9675.0000 (32c)
Internal Wall 2			140.1100			9.0000	1260.9900 (32c)
Internal Floor 1			131.2000			18.0000	2361.6000 (32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	41037.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.2709 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				30.0000	0.0500	1.5000	
E3 Sill				29.1000	0.0240	0.6984	
E4 Jamb				57.0000	0.0190	1.0830	
E5 Ground floor (normal)				54.4300	0.0410	2.2316	
R1 Head of roof window				3.6000	0.2400	0.8640	
R2 Sill of roof window				3.6000	0.2400	0.8640	
R3 Jamb of roof window				9.3600	0.2400	2.2464	
E6 Intermediate floor within a dwelling				54.4300	0.0200	1.0886	
E10 Eaves (insulation at ceiling level)				13.2000	0.0240	0.3168	
E11 Eaves (insulation at rafter level)				14.6000	0.0200	0.2920	
E12 Gable (insulation at ceiling level)				27.4000	0.0450	1.2330	
E13 Gable (insulation at rafter level)				2.6000	0.0550	0.1430	
E16 Corner (normal)				40.8600	0.0400	1.6344	
E17 Corner (inverted - internal area greater than external area)				20.3800	-0.0820	-1.6712	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5241 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	137.3737 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	119.7774	119.3004	118.8329	116.6369	116.2261	114.3135	114.3135	113.9593	115.0502	116.2261	117.0572	117.9261	(38)
Heat transfer coeff	257.1511	256.6741	256.2066	254.0106	253.5998	251.6872	251.6872	251.3330	252.4239	253.5998	254.4309	255.2999	(39)
Average = Sum(39)m / 12 =												254.0087	
HLP	0.9542	0.9524	0.9507	0.9425	0.9410	0.9339	0.9339	0.9326	0.9366	0.9410	0.9441	0.9473	(40)
HLP (average)												0.9425	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	(42a)
Hot water usage for baths	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	(42b)
Hot water usage for other uses	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	(42c)
Average daily hot water use (litres/day)												145.9086	(43)
Daily hot water use	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy conte	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Energy content (annual)										Total = Sum(45)m =		2278.3713	
Distribution loss (46)m = 0.15 x (45)m	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

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

Metabolic gains (Table 5), Watts													
(66)m	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131	(73)

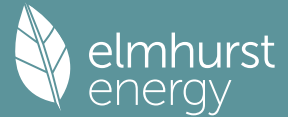
6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				2.5200	11.2829		0.6300	0.7000		0.7700	8.6895 (75)		
Southeast				26.5800	36.7938		0.6300	0.7000		0.7700	298.8834 (77)		
Southwest				1.2600	36.7938		0.6300	0.7000		0.7700	14.1683 (79)		
Northwest				13.0200	11.2829		0.6300	0.7000		0.7700	44.8957 (81)		
Southeast				1.4000	26.0000		0.6300	0.7000		1.0000	14.4472 (82)		
Northwest				1.4000	26.0000		0.6300	0.7000		1.0000	14.4472 (82)		
Solar gains		395.5313	702.3285	1032.8101	1393.4531	1659.7711	1690.0174	1611.8703	1407.5809	1157.2703	795.9915	479.0615	335.0052 (83)
Total gains		1374.5742	1680.0755	1980.6686	2288.3919	2495.8560	2471.0854	2358.4915	2160.1661	1937.9959	1630.3064	1376.5112	1286.5182 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501	

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alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767
util living area	0.9925	0.9830	0.9597	0.8979	0.7766	0.6059	0.4573	0.5142	0.7556	0.9386	0.9857	0.9942 (86)
Living	19.5880	19.7921	20.0955	20.4573	20.7308	20.8711	20.9100	20.9025	20.7961	20.4168	19.9274	19.5494
Non living	18.4405	18.7013	19.0855	19.5365	19.8537	20.0023	20.0337	20.0303	19.9336	19.4972	18.8807	18.3956
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2777	19.7921	20.0955	20.4573	20.7308	20.8711	20.9100	20.9025	20.7961	20.4168	19.9274	19.7523 (87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275 (88)
util rest of house	0.9909	0.9795	0.9514	0.8770	0.7339	0.5380	0.3729	0.4264	0.6948	0.9216	0.9822	0.9929 (89)
MIT 2	19.4515	18.7013	19.0855	19.5365	19.8537	20.0023	20.0337	20.0303	19.9336	19.4972	18.8807	18.7077 (90)
Living area fraction									fLA = Living area /	(4) =		0.0953 (91)
MIT	19.5302	18.8053	19.1817	19.6242	19.9373	20.0851	20.1172	20.1134	20.0158	19.5848	18.9805	18.8072 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5302	18.8053	19.1817	19.6242	19.9373	20.0851	20.1172	20.1134	20.0158	19.5848	18.9805	18.8072 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9896	0.9726	0.9400	0.8627	0.7232	0.5336	0.3707	0.4235	0.6853	0.9081	0.9759	0.9904	(94)
Useful gains	1360.3079	1634.0082	1861.9161	1974.2328	1805.0679	1318.5050	874.3772	914.9185	1328.0833	1480.4814	1343.2795	1274.2206	(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	3916.4593	3569.1205	3249.1376	2724.0700	2088.9702	1380.5281	885.2241	933.2964	1493.2880	2278.5483	3022.7554	3729.2220	(97)
Space heating kWh	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210	(98a)
Space heating requirement - total per year (kWh/year)												8614.8766	
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	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8614.8766	
Space heating per m2										(98c) / (4) =		31.9661	(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 %)													281.3248	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	1901.7767	1300.3954	1032.0928	539.8828	211.2234	0.0000	0.0000	0.0000	0.0000	593.7618	1209.2227	1826.5210	(98)	
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248	(210)	
Space heating fuel (main heating system)	676.0074	462.2398	366.8687	191.9073	75.0817	0.0000	0.0000	0.0000	0.0000	211.0591	429.8315	649.2569	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)	
Efficiency of water heater	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	(216)	
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-41.4772	-63.4404	-98.1997	-116.5337	-128.3390	-117.4023	-115.4581	-106.1758	-89.8701	-73.9620	-46.8801	-35.1748	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												3062.2524	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												178.1926		
Water heating fuel used												1663.4845	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												332.8276	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-1032.9132	(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														

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4025.6513 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3062.2524	16.4900	504.9654 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.4845	16.4900	274.3086 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	16.4900	54.8833 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1032.9132	16.4900	-170.3274
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-170.3274 (252)
Total energy cost			663.8299 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7599 (257)
SAP value		87.6825
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3062.2524	0.1558	477.0695 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.4845	0.1409	234.4080 (264)
Space and water heating			711.4775 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1032.9132	0.1338	-138.1721
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-138.1721 (269)
Total CO2, kg/year			621.3428 (272)
CO2 emissions per m2			2.3100 (273)
EI value			97.3526
EI rating			97 (274)
EI band			A

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

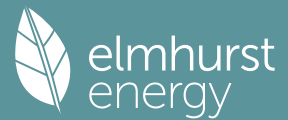
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	60.0000 / (5) = 0.0921 (8)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Yes
Pressure test	Blower Door
Pressure Test Method	5.0000 (17)
Measured/design AP50	0.3421 (18)
Infiltration rate	3 (19)
Number of sides sheltered	
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.2651 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000	(22)
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250	(22a)
Effective ac	0.2983	0.2850	0.2916	0.2585	0.2585	0.2254	0.2320	0.2254	0.2386	0.2585	0.2519	0.2718	(22b)
	0.5445	0.5406	0.5425	0.5334	0.5334	0.5254	0.5269	0.5254	0.5285	0.5334	0.5317	0.5369	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m2)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496			(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)

Heat capacity Cm = Sum(A x k)

(28)...(30) + (32) + (32a)...(32e) = 41037.0000 (34)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0240	0.6984
E4 Jamb	57.0000	0.0190	1.0830
E5 Ground floor (normal)	54.4300	0.0410	2.2316
R1 Head of roof window	3.6000	0.2400	0.8640
R2 Sill of roof window	3.6000	0.2400	0.8640
R3 Jamb of roof window	9.3600	0.2400	2.2464
E6 Intermediate floor within a dwelling	54.4300	0.0200	1.0886
E10 Eaves (insulation at ceiling level)	13.2000	0.0240	0.3168
E11 Eaves (insulation at rafter level)	14.6000	0.0200	0.2920
E12 Gable (insulation at ceiling level)	27.4000	0.0450	1.2330
E13 Gable (insulation at rafter level)	2.6000	0.0550	0.1430
E16 Corner (normal)	40.8600	0.0400	1.6344
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0820	-1.6712

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

12.5241 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 137.3737 (37)

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

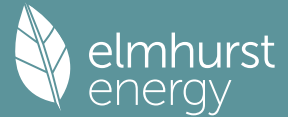
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	117.0572	116.2261	116.6369	114.6771	114.6771	112.9534	113.2792	112.9534	113.6145	114.6771	114.3135	115.4327	(38)
Average = Sum(39)m / 12 =	254.4309	253.5998	254.0106	252.0508	252.0508	250.3271	250.6529	250.3271	250.9882	252.0508	251.6872	252.0819	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9441	0.9410	0.9425	0.9353	0.9353	0.9289	0.9301	0.9289	0.9313	0.9353	0.9339	0.9381	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers													
80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	80.2518	(42a)
Hot water usage for baths													
32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	32.0772	(42b)
Hot water usage for other uses													
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	46.2980	(42c)
Average daily hot water use (litres/day)													145.9086 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1286 (55)
Total storage loss													
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage													
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	291.2044	(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													
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	291.2044	(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)

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Heat gains from water heating, kWh/month
124.2946 110.4280 118.4120 108.3505 106.8088 96.6480 94.4857 99.9938 99.2330 109.4887 114.0263 124.0569 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				2.5200	12.9326	0.6300	0.7000		0.7700		9.9600 (75)	
Southeast				26.5800	40.6744	0.6300	0.7000		0.7700		330.4058 (77)	
Southwest				1.2600	40.6744	0.6300	0.7000		0.7700		15.6626 (79)	
Northwest				13.0200	12.9326	0.6300	0.7000		0.7700		51.4598 (81)	
Southeast				1.4000	30.0000	0.6300	0.7000		1.0000		16.6698 (82)	
Northwest				1.4000	30.0000	0.6300	0.7000		1.0000		16.6698 (82)	
Solar gains	440.8277	718.0778	1048.9991	1443.9948	1686.3668	1837.2534	1716.9334	1512.7429	1250.5400	854.5993	547.2114	369.6359 (83)
Total gains	1419.8706	1695.8248	1996.8577	2338.9337	2522.4517	2618.3213	2463.5546	2265.3282	2031.2656	1688.9142	1444.6612	1321.1490 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	44.8026	44.9494	44.8767	45.2257	45.2257	45.5371	45.4779	45.5371	45.4171	45.2257	45.2910	45.0905	
alpha	3.9868	3.9966	3.9918	4.0150	4.0150	4.0358	4.0319	4.0358	4.0278	4.0150	4.0194	4.0060	
util living area	0.9912	0.9820	0.9546	0.8788	0.7410	0.5225	0.3622	0.4022	0.6906	0.9215	0.9817	0.9932	(86)
Living	19.6485	19.8296	20.1575	20.5257	20.7750	20.8965	20.9188	20.9166	20.8416	20.4934	20.0054	19.6154	
Non living	18.5241	18.7563	19.1686	19.6231	19.9055	20.0274	20.0420	20.0422	19.9811	19.5938	18.9861	18.4858	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3086	19.8296	20.1575	20.5257	20.7750	20.8965	20.9188	20.9166	20.8416	20.4934	20.0054	19.8091	(87)
Th 2	20.1302	20.1328	20.1315	20.1376	20.1376	20.1430	20.1420	20.1430	20.1410	20.1376	20.1388	20.1353	(88)
util rest of house	0.9893	0.9783	0.9451	0.8544	0.6931	0.4517	0.2778	0.3121	0.6208	0.8999	0.9773	0.9917	(89)
MIT 2	19.4899	18.7563	19.1686	19.6231	19.9055	20.0274	20.0420	20.0422	19.9811	19.5938	18.9861	18.7830	(90)
Living area fraction									fLA = Living area / (4) =			0.0953	(91)
MIT	19.5679	18.8586	19.2628	19.7091	19.9883	20.1102	20.1256	20.1255	20.0631	19.6795	19.0832	18.8808	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5679	18.8586	19.2628	19.7091	19.9883	20.1102	20.1256	20.1255	20.0631	19.6795	19.0832	18.8808	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9711	0.9333	0.8403	0.6840	0.4489	0.2762	0.3103	0.6139	0.8857	0.9699	0.9889	(94)
Useful gains	1402.7074	1646.8540	1863.6357	1965.5208	1725.4070	1175.2520	680.3703	702.8506	1246.9854	1495.9430	1401.2049	1306.4787	(95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000	(96)
Heat loss rate W	3833.7417	3514.5289	3140.2905	2598.4239	1937.8544	1204.1219	683.1777	707.2976	1346.0700	2162.4637	2940.5113	3635.5543	(97)
Space heating kWh	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322	(98a)
Space heating requirement - total per year (kWh/year)												7964.3736	
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	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7964.3736	
Space heating per m ²										(98c) / (4) =		29.5524	(99)

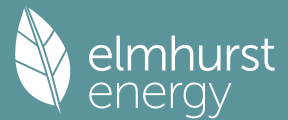
9a. Energy requirements - Individual heating systems, including micro-CHP

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

Fraction of space heat from main system(s)													0.0000 (201)
Efficiency of main space heating system 1 (in %)													1.0000 (202)
Efficiency of main space heating system 2 (in %)													280.7686 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (207)
													65.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1808.6895	1255.0775	949.8311	455.6903	158.0609	0.0000	0.0000	0.0000	0.0000	495.8914	1108.3006	1732.8322	(98)

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Space heating efficiency (main heating system 1)	280.7686	280.7686	280.7686	280.7686	0.0000	0.0000	0.0000	0.0000	280.7686	280.7686	280.7686	(210)
Space heating fuel (main heating system)	644.1922	447.0149	338.2968	162.3010	56.2958	0.0000	0.0000	0.0000	0.0000	176.6192	394.7381	617.1745 (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	(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	(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	(215)
Water heating												
Water heating requirement	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889 (216)
Fuel for water heating, kWh/month	163.8259	144.8693	153.8970	138.3977	134.3129	118.6458	113.5135	122.8103	123.0088	138.8361	147.9774	163.4246 (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	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-45.9861	-64.9702	-99.3414	-118.6649	-128.5147	-123.7911	-120.1742	-111.4798	-95.2246	-78.1014	-52.8256	-38.6839 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2836.6324 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1889
Water heating fuel used												1663.5193 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1077.7579 (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												3755.2214 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2836.6324	28.4300	806.4546 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	28.4300	472.9385 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	28.4300	94.6229 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.7579	28.4300	-306.4066
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-306.4066 (252)
Total energy cost			1067.6094 (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	2836.6324	0.1562	443.1503 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.5193	0.1409	234.4130 (264)
Space and water heating			677.5633 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.7579	0.1338	-144.2246
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-144.2246 (269)
Total CO2, kg/year			581.3760 (272)

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

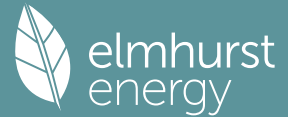
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2836.6324	1.5783	4477.1574 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	1.5210	2530.2928 (278)

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Space and water heating			7007.4502 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.7579	1.4945	-1610.7391
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1610.7391 (283)
Total Primary energy kWh/year			5907.2133 (286)

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Plot Reference	02	Issued on Date	12/02/2026
Assessment Reference	00001	Plot Type Ref	
Plot Address	Plot B, Adj 21, Danesbury Park Road, Welwyn, AL6 9SH	SAP Version	10.2
SAP Rating	85 B	DER	2.86
Environmental	97 A	TER	6.36
CO ₂ Emissions (t/year)	0.72	% DER < TER	55.03
Compliance Check	See BREL	DFEE	34.51
% DPER < TPER	12.34	TFEE	35.04
		% DFEE < TFEE	1.53
		DPER	29.59
		TPER	33.75
Assessor Details	Mrs. Nicola Battista	Assessor ID	L706-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (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	6 * 10 = 60.0000 (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 60.0000 / (5) = 0.0921 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3421 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2651 (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	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115 (22b)
Effective ac	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			43.3800	1.3258	57.5114		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Opening Type 3			2.8000	1.2357	3.4601		(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000 (28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000 (29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000 (29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000 (30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100 (30)
Total net area of external elements Aum(A, m ²)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496		(33)
Main dwelling							
Internal Wall 1			129.0000			75.0000	9675.0000 (32c)
Internal Wall 2			140.1100			9.0000	1260.9900 (32c)
Internal Floor 1			131.2000			18.0000	2361.6000 (30)
Internal Ceiling 1			138.3000			9.0000	1244.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	41037.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.2709 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0240	0.6984
E4 Jamb	57.0000	0.0190	1.0830
E5 Ground floor (normal)	54.4300	0.0410	2.2316
R1 Head of roof window	3.6000	0.2400	0.8640
R2 Sill of roof window	3.6000	0.2400	0.8640
R3 Jamb of roof window	9.3600	0.2400	2.2464
E6 Intermediate floor within a dwelling	54.4300	0.0200	1.0886
E10 Eaves (insulation at ceiling level)	13.2000	0.0240	0.3168
E11 Eaves (insulation at rafter level)	14.6000	0.0200	0.2920
E12 Gable (insulation at ceiling level)	27.4000	0.0450	1.2330
E13 Gable (insulation at rafter level)	2.6000	0.0550	0.1430
E16 Corner (normal)	40.8600	0.0400	1.6344
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0820	-1.6712
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.5241 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	137.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	119.7774	119.3004	118.8329	116.6369	116.2261	114.3135	114.3135	113.9593	115.0502	116.2261	117.0572	117.9261	(38)
Heat transfer coeff	257.1511	256.6741	256.2066	254.0106	253.5998	251.6872	251.6872	251.3330	252.4239	253.5998	254.4309	255.2999	(39)
Average = Sum(39)m / 12 =												254.0087	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9542	0.9524	0.9507	0.9425	0.9410	0.9339	0.9339	0.9326	0.9366	0.9410	0.9441	0.9473	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	(42a)
Hot water usage for baths	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	(42b)
Hot water usage for other uses	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	(42c)
Average daily hot water use (litres/day)												145.9086	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Distribution loss (46)m = 0.15 x (45)m	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
12Total per year (kWh/year)												2964.2063	(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	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(65)

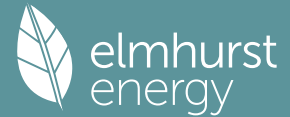
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains	893.9941	919.8039	879.2568	853.9617	809.1198	778.6730	744.8458	747.7553	769.9857	795.9503	845.0732	874.5664	(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
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Northeast			1.2600		11.2829		0.6300		0.7000		0.7700		4.3447 (75)
Southeast			26.5800		36.7938		0.6300		0.7000		0.7700		298.8834 (77)
Southwest			2.5200		36.7938		0.6300		0.7000		0.7700		28.3366 (79)
Northwest			13.0200		11.2829		0.6300		0.7000		0.7700		44.8957 (81)
Southeast			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Northwest			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)

Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821	(83)
Total gains	1299.3489	1637.4223	1929.1540	2262.1615	2479.5438	2476.6867	2365.4988	2167.5674	1943.5951	1607.8070	1335.6382	1218.1485	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501	
alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767	
util living area	0.9938	0.9844	0.9628	0.9009	0.7794	0.6048	0.4561	0.5126	0.7543	0.9410	0.9871	0.9952	(86)
Living	19.5548	19.7740	20.0757	20.4497	20.7281	20.8715	20.9101	20.9027	20.7969	20.4090	19.9099	19.5190	
Non living	18.3982	18.6785	19.0610	19.5275	19.8510	20.0026	20.0337	20.0304	19.9344	19.4878	18.8585	18.3567	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2607	19.7740	20.0757	20.4497	20.7281	20.8715	20.9101	20.9027	20.7969	20.4090	19.9099	19.7262	(87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275	(88)
util rest of house	0.9925	0.9812	0.9551	0.8804	0.7368	0.5370	0.3719	0.4250	0.6934	0.9246	0.9839	0.9942	(89)
MIT 2	19.4346	18.6785	19.0610	19.5275	19.8510	20.0026	20.0337	20.0304	19.9344	19.4878	18.8585	18.6758	(90)
Living area fraction									fLA =	Living area / (4) =		0.0953	(91)
MIT	19.5133	18.7829	19.1577	19.6154	19.9345	20.0854	20.1172	20.1135	20.0165	19.5756	18.9587	18.7759	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5133	18.7829	19.1577	19.6154	19.9345	20.0854	20.1172	20.1135	20.0165	19.5756	18.9587	18.7759	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9746	0.9441	0.8661	0.7261	0.5326	0.3697	0.4222	0.6840	0.9112	0.9780	0.9920	(94)
Useful gains	1288.2075	1595.8627	1821.3756	1959.3145	1800.3001	1318.9854	874.5051	915.1583	1329.3943	1464.9987	1306.2408	1208.4538	(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	3912.1188	3563.3777	3242.9751	2721.8240	2088.2791	1380.5950	885.2423	933.3303	1493.4769	2276.2038	3017.2250	3721.2296	(97)
Space heating kWh	1952.1900	1322.1701	1057.6701	549.0068	214.2564	0.0000	0.0000	0.0000	0.0000	603.5366	1231.9087	1869.5052	(98a)
Space heating requirement - total per year (kWh/year)												8800.2437	
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	1952.1900	1322.1701	1057.6701	549.0068	214.2564	0.0000	0.0000	0.0000	0.0000	603.5366	1231.9087	1869.5052	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8800.2437	
Space heating per m2										(98c) / (4) =		32.6540	(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 %)													281.3248 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1952.1900	1322.1701	1057.6701	549.0068	214.2564	0.0000	0.0000	0.0000	0.0000	603.5366	1231.9087	1869.5052	(98)
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248	(210)
Space heating fuel (main heating system)	693.9273	469.9799	375.9604	195.1505	76.1598	0.0000	0.0000	0.0000	0.0000	214.5337	437.8954	664.5361	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
Efficiency of water heater	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	(216)
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

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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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											3128.1431	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											178.1926	
Water heating fuel used											1663.4845	(219)
Space cooling fuel											0.0000	(221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year											0.0000	(231)
Electricity for lighting (calculated in Appendix L)											332.8276	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											0.0000	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											5124.4553	(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	3128.1431	0.1558	487.4067 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.4845	0.1409	234.4080 (264)
Space and water heating			721.8147 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Total CO2, kg/year			769.8520 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8600 (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	3128.1431	1.5768	4932.5010 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.4845	1.5210	2530.2399 (278)
Space and water heating			7462.7409 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Total Primary energy kWh/year			7973.2430 (286)
Dwelling Primary energy Rate (DPER)			29.5900 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

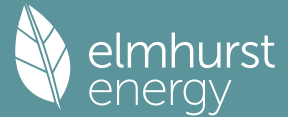
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0614 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3114 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2413 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
Effective ac	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836 (22b)
	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			43.3800	1.1450	49.6718		(27)
TER Roof Window			2.8000	1.1450	4.4569		(27a)
Heatloss Floor 1			138.3000	0.1300	17.9790		(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546		(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1800	0.0540		(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300		(30)
External Roof 2	19.8900	2.8000	17.0900	0.1100	1.8799		(30)
Total net area of external elements Aum(A, m2)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	119.5162	(33)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0500	1.4550
E4 Jamb	57.0000	0.0500	2.8500
E5 Ground floor (normal)	54.4300	0.1600	8.7088
R1 Head of roof window	3.6000	0.0800	0.2880
R2 Sill of roof window	3.6000	0.0600	0.2160
R3 Jamb of roof window	9.3600	0.0800	0.7488
E6 Intermediate floor within a dwelling	54.4300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	13.2000	0.0600	0.7920
E11 Eaves (insulation at rafter level)	14.6000	0.0400	0.5840
E12 Gable (insulation at ceiling level)	27.4000	0.0600	1.6440
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E16 Corner (normal)	40.8600	0.0900	3.6774
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0900	-1.8342

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

20.8378 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 140.3540 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	117.6717	117.2765	116.8891	115.0696	114.7292	113.1445	113.1445	112.8510	113.7549	114.7292	115.4179	116.1379 (38)
Heat transfer coeff	258.0257	257.6305	257.2431	255.4236	255.0832	253.4985	253.4985	253.2050	254.1089	255.0832	255.7719	256.4918 (39)
Average = Sum(39)m / 12 =												255.4220

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9574	0.9560	0.9545	0.9478	0.9465	0.9406	0.9406	0.9395	0.9429	0.9465	0.9491	0.9517 (40)
HLP (average)												0.9478
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

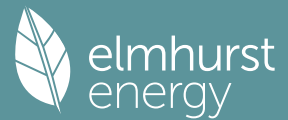
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0923 (42)
Hot water usage for mixer showers												
76.0673	74.9241	73.2583	70.0712	67.7191	65.0961	63.6052	65.2584	67.0706	69.8869	73.1425	75.7758 (42a)	
Hot water usage for baths												
32.8346	32.3470	31.6603	30.3941	29.4461	28.3948	27.8269	28.5088	29.2513	30.3762	31.6684	32.7236 (42b)	
Hot water usage for other uses												
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)	
Average daily hot water use (litres/day)												142.6635 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
155.1999	151.8856	147.8495	141.7126	136.7289	131.3711	129.3124	133.3310	137.5692	143.1940	149.4254	154.7975 (44)	
Energy content (annual)	245.7987	216.2830	227.2392	193.9975	184.0634	161.5361	156.3921	165.0916	169.6366	194.3129	212.8839	242.3754 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2369.6106
36.8698	32.4425	34.0859	29.0996	27.6095	24.2304	23.4588	24.7637	25.4455	29.1469	31.9326	36.3563 (46)	
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)	
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
292.3937	258.3688	273.8341	239.0894	230.6583	206.6280	202.9870	211.6865	214.7284	240.9078	257.9757	288.9703 (62)	
WWHRS	-34.7748	-30.7551	-32.2050	-26.6670	-24.8527	-21.2666	-19.9341	-21.1979	-22.0033	-25.9394	-29.3862 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
257.6189	227.6137	241.6292	212.4224	205.8057	185.3613	183.0529	190.4887	192.7252	214.9684	228.5895	254.8395 (64)	
12Total per year (kWh/year)												2595.1153 (64)
Electric shower(s)												2595 (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)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
119.0040	105.5827	112.8330	100.5776	98.4770	89.7842	89.2763	92.1689	92.4776	101.8849	106.8574	117.8658 (65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	159.9516	157.1171	151.6572	139.6912	132.3616	124.7003	119.9950	123.8829	128.4412	136.9421	148.4130	158.4217	(72)
Total internal gains	889.8831	915.5936	874.7581	846.1660	800.9211	769.1400	737.8439	737.2379	760.6032	788.7302	838.1163	869.2450	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				1.2600	11.2829	0.6300	0.7000	0.7700	4.3447 (75)				
Southeast				26.5800	36.7938	0.6300	0.7000	0.7700	298.8834 (77)				
Southwest				2.5200	36.7938	0.6300	0.7000	0.7700	28.3366 (79)				
Northwest				13.0200	11.2829	0.6300	0.7000	0.7700	44.8957 (81)				
Southeast				1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)				
Northwest				1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)				
Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821	(83)
Total gains	1295.2379	1633.2120	1924.6553	2254.3658	2471.3451	2467.1537	2358.4970	2157.0500	1934.2126	1600.5869	1328.6813	1212.8271	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1784	44.2462	44.3128	44.6285	44.6880	44.9674	44.9674	45.0195	44.8594	44.6880	44.5677	44.4426	
alpha	3.9452	3.9497	3.9542	3.9752	3.9792	3.9978	3.9978	4.0013	3.9906	3.9792	3.9712	3.9628	
util living area	0.9939	0.9846	0.9632	0.9025	0.7825	0.6095	0.4601	0.5179	0.7586	0.9422	0.9873	0.9953	(86)
MIT	19.1675	19.4591	19.8613	20.3579	20.7333	20.9278	20.9816	20.9709	20.8258	20.3036	19.6363	19.1158	(87)
Th 2	20.1190	20.1202	20.1214	20.1271	20.1282	20.1331	20.1331	20.1340	20.1312	20.1282	20.1260	20.1238	(88)
util rest of house	0.9926	0.9814	0.9555	0.8823	0.7400	0.5412	0.3748	0.4291	0.6977	0.9260	0.9842	0.9943	(89)
MIT 2	17.9431	18.3154	18.8247	19.4415	19.8776	20.0805	20.1240	20.1185	19.9882	19.3879	18.5473	17.8802	(90)
Living area fraction									fLA = Living area / (4) =			0.0953	(91)
MIT	18.0598	18.4243	18.9235	19.5288	19.9591	20.1612	20.2057	20.1997	20.0680	19.4752	18.6511	17.9980	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0598	18.4243	18.9235	19.5288	19.9591	20.1612	20.2057	20.1997	20.0680	19.4752	18.6511	17.9980	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9880	0.9727	0.9417	0.8657	0.7309	0.5436	0.3821	0.4361	0.6928	0.9103	0.9765	0.9905	(94)
Useful gains	1279.7315	1588.6529	1812.4918	1951.6528	1806.4098	1341.0787	901.2740	940.6505	1340.0884	1457.0218	1297.4896	1201.3289	(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	3550.3802	3484.2840	3195.8655	2714.8402	2106.7634	1409.7604	914.0405	962.1002	1516.5307	2263.9020	2954.4418	3539.0700	(97)
Space heating kWh	1689.3626	1273.8640	1029.2300	549.4949	223.4631	0.0000	0.0000	0.0000	0.0000	600.3189	1193.0055	1739.2794	(98a)
Space heating requirement - total per year (kWh/year)												8298.0185	
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	1689.3626	1273.8640	1029.2300	549.4949	223.4631	0.0000	0.0000	0.0000	0.0000	600.3189	1193.0055	1739.2794	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8298.0185	
Space heating per m ²										(98c) / (4) =		30.7904	(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	1689.3626	1273.8640	1029.2300	549.4949	223.4631	0.0000	0.0000	0.0000	0.0000	600.3189	1193.0055	1739.2794	(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)	1830.2953	1380.1344	1115.0921	595.3358	242.1052	0.0000	0.0000	0.0000	0.0000	650.3997	1292.5304	1884.3763	(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	257.6189	227.6137	241.6292	212.4224	205.8057	185.3613	183.0529	190.4887	192.7252	214.9684	228.5895	254.8395	(64)
Efficiency of water heater												79.8000	(216)

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(217)m	87.4943	87.3073	86.9358	86.0929	84.2448	79.8000	79.8000	79.8000	79.8000	86.2356	87.2183	87.5383	(217)
Fuel for water heating, kWh/month	294.4407	260.7040	277.9397	246.7361	244.2949	232.2824	229.3897	238.7076	241.5103	249.2804	262.0890	291.1177	(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	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	46.6419	37.4179	33.6906	24.6832	19.0660	15.5771	17.3927	22.6076	29.3651	38.5286	43.5179	47.9382	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-109.5638	-145.3587	-196.6309	-207.4344	-212.5216	-194.1360	-191.3056	-185.6103	-174.6022	-158.9617	-116.9652	-95.7883	(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	-92.9346	-190.8548	-371.2829	-546.5813	-712.6148	-712.7430	-704.7246	-601.5630	-447.2755	-269.5853	-122.8963	-73.8892	(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												8990.2692	(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												3068.4925	(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)												376.4268	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6835.8240	(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												5685.3645	(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	8990.2692	0.2100	1887.9565 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3068.4925	0.2100	644.3834 (264)
Space and water heating			2532.3400 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	376.4268	0.1443	54.3300 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.8787	0.1360	-270.4319
PV Unit electricity exported	-4846.9453	0.1265	-613.0659
Total			-883.4977 (269)
Total CO2, kg/year			1715.1015 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.3600 (273)

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

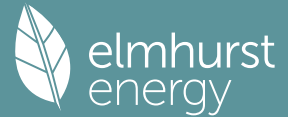
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8990.2692	1.1300	10159.0042 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3068.4925	1.1300	3467.3965 (278)
Space and water heating			13626.4007 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	376.4268	1.5338	577.3760 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.8787	1.5026	-2988.5005
PV Unit electricity exported	-4846.9453	0.4643	-2250.4950
Total			-5238.9955 (283)
Total Primary energy kWh/year			9094.8820 (286)
Target Primary Energy Rate (TPER)			33.7500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (5)

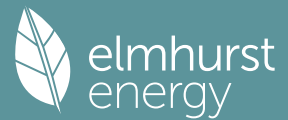
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2. Ventilation rate

											m3 per hour			
Number of open chimneys													0 * 80 =	0.0000 (6a)
Number of open flues													0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 =	0.0000 (6d)
Number of flues attached to other heater													0 * 35 =	0.0000 (6e)
Number of blocked chimneys													0 * 20 =	0.0000 (6f)
Number of intermittent extract fans													4 * 10 =	40.0000 (7a)
Number of passive vents													0 * 10 =	0.0000 (7b)
Number of flueless gas fires													0 * 40 =	0.0000 (7c)
													Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000	/ (5) =	0.0614 (8)	
Pressure test													Yes	
Pressure Test Method													Blower Door	
Measured/design AP50													5.0000 (17)	
Infiltration rate													0.3114 (18)	
Number of sides sheltered													3 (19)	
Shelter factor													(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.2413 (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	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836	(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	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402	(25)	

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Daily hot water use	78.4007	76.2325	73.8596	71.1436	68.5295	65.5651	64.5933	67.4652	69.7724	72.7251	75.7282	78.3752 (44)
Energy content (annual)	115.4194	100.8711	105.5438	92.9313	88.3072	75.8239	71.3775	79.4078	80.9325	93.7137	102.3492	115.0998 (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 (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (62)
Total heat required for water heating calculated for each month	98.1065	85.7404	89.7122	78.9916	75.0612	64.4503	60.6709	67.4966	68.7926	79.6566	86.9968	97.8348 (63a)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64)
Output from w/h	98.1065	85.7404	89.7122	78.9916	75.0612	64.4503	60.6709	67.4966	68.7926	79.6566	86.9968	97.8348 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											953.5105 (64)
Electric shower(s)	60.9172	54.2777	59.2692	56.5599	57.6212	54.9650	56.7972	57.6212	56.5599	59.2692	58.1547	60.9172 (64a)
Heat gains from water heating, kWh/month	39.7559	35.0045	37.2454	33.8879	33.1706	29.8538	29.3670	31.2795	31.3381	34.7314	36.2879	39.6880 (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	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	154.6140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	224.4770	248.5282	224.4770	231.9596	224.4770	231.9596	224.4770	224.4770	231.9596	224.4770	231.9596	224.4770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.0702	437.5641	426.2396	402.1310	371.6983	343.0959	323.9877	319.4937	330.8183	354.9268	385.3595	413.9620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	38.4614	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	53.4354	52.0901	50.0610	47.0665	44.5841	41.4636	39.4718	42.0423	43.5252	46.6821	50.3998	53.3441	(72)
Total internal gains	780.3668	807.5666	770.1618	750.5413	710.1437	685.9033	657.3207	655.3973	675.6872	695.4701	737.1032	761.1673	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	

Northeast					1.2600	11.2829		0.6300	0.7000		0.7700		4.3447 (75)	
Southeast					26.5800	36.7938		0.6300	0.7000		0.7700		298.8834 (77)	
Southwest					2.5200	36.7938		0.6300	0.7000		0.7700		28.3366 (79)	
Northwest					13.0200	11.2829		0.6300	0.7000		0.7700		44.8957 (81)	
Southeast					1.4000	26.0000		0.6300	0.7000		1.0000		14.4472 (82)	
Northwest					1.4000	26.0000		0.6300	0.7000		1.0000		14.4472 (82)	

Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821 (83)		
Total gains	1185.7216	1525.1850	1820.0590	2158.7411	2380.5677	2383.9170	2277.9738	2075.2094	1849.2966	1507.3268	1227.6682	1104.7495 (84)		

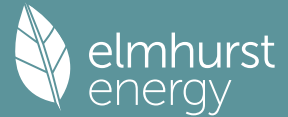
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.6947	44.7640	44.8322	45.1553	45.2163	45.5024	45.5024	45.5557	45.3918	45.2163	45.0931	44.9651
alpha	3.9796	3.9843	3.9888	4.0104	4.0144	4.0335	4.0335	4.0370	4.0261	4.0144	4.0062	3.9977
util living area	0.9955	0.9877	0.9688	0.9116	0.7944	0.6211	0.4702	0.5305	0.7742	0.9509	0.9903	0.9966 (86)
MIT	19.1271	19.4217	19.8289	20.3371	20.7234	20.9250	20.9809	20.9694	20.8161	20.2748	19.5988	19.0759 (87)
Th 2	20.1283	20.1295	20.1307	20.1364	20.1375	20.1424	20.1424	20.1434	20.1405	20.1375	20.1353	20.1331 (88)
util rest of house	0.9946	0.9851	0.9621	0.8928	0.7532	0.5530	0.3842	0.4412	0.7150	0.9367	0.9879	0.9959 (89)
MIT 2	18.3899	18.6837	19.0868	19.5818	19.9336	20.0996	20.1350	20.1305	20.0216	19.5318	18.8656	18.3424 (90)
Living area fraction	18.4602	18.7541	19.1575	19.6538	20.0089	20.1782	20.2156	20.2104	20.0973	19.6026	18.9355	18.4123 (91)
MIT	18.4602	18.7541	19.1575	19.6538	20.0089	20.1782	20.2156	20.2104	20.0973	19.6026	18.9355	18.4123 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4602	18.7541	19.1575	19.6538	20.0089	20.1782	20.2156	20.2104	20.0973	19.6026	18.9355	18.4123 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9920	0.9796	0.9525	0.8803	0.7464	0.5560	0.3918	0.4485	0.7117	0.9255	0.9832	0.9938	(94)
Ext temp.	1176.2183	1494.0635	1733.6254	1900.4433	1776.8169	1325.4835	892.4192	930.6907	1316.0661	1394.9829	1207.0204	1097.9415	(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	3611.4896	3527.9402	3218.3321	2714.7130	2094.6862	1397.4479	905.7716	953.4578	1506.0901	2269.5905	2991.9062	3602.9807	(97)
Space heating requirement - total per year (kWh/year)	1811.8418	1366.7652	1104.6218	586.2742	236.4948	0.0000	0.0000	0.0000	0.0000	650.7081	1285.1178	1863.7492	(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)

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Solar heating contribution - total per year (kWh/year) 0.0000
 Space heating kWh
 1811.8418 1366.7652 1104.6218 586.2742 236.4948 0.0000 0.0000 0.0000 0.0000 650.7081 1285.1178 1863.7492 (98c)
 Space heating requirement after solar contribution - total per year (kWh/year) 8905.5729
 Space heating per m2 (98c) / (4) = 33.0448 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2354.8709	1853.8345	1901.7078	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8441	0.9028	0.8689	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1987.8561	1673.5620	1652.4236	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	468.7125	630.9092	478.1063	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh												
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	117.1781	157.7273	119.5266	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												394.4320 (107)
Energy for space cooling												33.0448 (99)
Total												1.4636 (108)
Fabric Energy Efficiency (DFEE)												34.5084 (109)
												34.5 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (5)

2. Ventilation rate

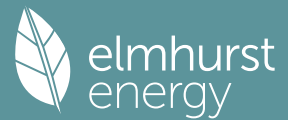
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0614 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3114 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2413 (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	0.3077	0.3017	0.2956	0.2655	0.2594	0.2293	0.2293	0.2232	0.2413	0.2594	0.2715	0.2836 (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	0.5473	0.5455	0.5437	0.5352	0.5337	0.5263	0.5263	0.5249	0.5291	0.5337	0.5369	0.5402 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			43.3800	1.1450	49.6718		(27)
TER Roof Window			2.8000	1.1450	4.4569		(27a)
Heatloss Floor 1			138.3000	0.1300	17.9790		(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546		(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1800	0.0540		(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300		(30)
External Roof 2	19.8900	2.8000	17.0900	0.1100	1.8799		(30)
Total net area of external elements Aum(A, m2)			493.7300				(31)

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Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 119.5162 (33)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0500	1.4550
E4 Jamb	57.0000	0.0500	2.8500
E5 Ground floor (normal)	54.4300	0.1600	8.7088
R1 Head of roof window	3.6000	0.0800	0.2880
R2 Sill of roof window	3.6000	0.0600	0.2160
R3 Jamb of roof window	9.3600	0.0800	0.7488
E6 Intermediate floor within a dwelling	54.4300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	13.2000	0.0600	0.7920
E11 Eaves (insulation at rafter level)	14.6000	0.0400	0.5840
E12 Gable (insulation at ceiling level)	27.4000	0.0600	1.6440
E13 Gable (insulation at rafter level)	2.6000	0.0800	0.2080
E16 Corner (normal)	40.8600	0.0900	3.6774
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0900	-1.8342

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

20.8378 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 140.3540 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	117.6717	117.2765	116.8891	115.0696	114.7292	113.1445	113.1445	112.8510	113.7549	114.7292	115.4179	116.1379	(38)
Heat transfer coeff	258.0257	257.6305	257.2431	255.4236	255.0832	253.4985	253.4985	253.2050	254.1089	255.0832	255.7719	256.4918	(39)
Average = Sum(39)m / 12 =												255.4220	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9574	0.9560	0.9545	0.9478	0.9465	0.9406	0.9406	0.9395	0.9429	0.9465	0.9491	0.9517	(40)
HLP (average)												0.9478	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy

3.0923 (42)

Hot water usage for mixer showers

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths

32.8346 32.3470 31.6603 30.3941 29.4461 28.3948 27.8269 28.5088 29.2513 30.3762 31.6684 32.7236 (42b)

Hot water usage for other uses

46.2980 44.6145 42.9309 41.2473 39.5638 37.8802 37.8802 39.5638 41.2473 42.9309 44.6145 46.2980 (42c)

Average daily hot water use (litres/day)

72.5320 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	79.1327	76.9615	74.5912	71.6415	69.0098	66.2750	65.7072	68.0726	70.4986	73.3071	76.2829	79.0217	(44)
Energy conte	125.3268	109.5921	114.6439	98.0736	92.9005	81.4928	79.4671	84.2881	86.9319	99.4771	108.6790	123.7288	(45)
Energy content (annual)													

Total = Sum(45)m = 1204.6018

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

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)

Water storage loss (or HIU loss):

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)

Total storage loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)

If cylinder contains dedicated solar storage

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)

Primary loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Combi loss

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (62)

Total heat required for water heating calculated for each month

106.5278 93.1533 97.4473 83.3626 78.9654 69.2689 67.5470 71.6449 73.8921 84.5555 92.3771 105.1695 (63a)

WWHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)

PV diverter

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

Solar input

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

FGHRS

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64)

Output from w/h

106.5278 93.1533 97.4473 83.3626 78.9654 69.2689 67.5470 71.6449 73.8921 84.5555 92.3771 105.1695 (64)

12Total per year (kWh/year)

Electric shower(s) 60.9172 54.2777 59.2692 56.5599 57.6212 54.9650 56.7972 57.6212 56.5599 59.2692 58.1547 60.9172 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 692.9295 (64a)

Heat gains from water heating, kWh/month

41.8612 36.8578 39.1791 34.9806 34.1467 31.0585 31.0861 32.3165 32.6130 35.9562 37.6330 41.5217 (65)

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

Metabolic gains (Table 5), Watts

(66)m 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 154.6140 (66)

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

224.4770 248.5282 224.4770 231.9596 224.4770 231.9596 224.4770 224.4770 231.9596 224.4770 231.9596 224.4770 (67)

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

433.0702 437.5641 426.2396 402.1310 371.6983 343.0959 323.9877 319.4937 330.8183 354.9268 385.3595 413.9620 (68)

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

38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 38.4614 (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)

-123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 -123.6912 (71)

Water heating gains (Table 5)

56.2651 54.8478 52.6601 48.5842 45.8960 43.1368 41.7823 43.4362 45.2958 48.3282 52.2680 55.8087 (72)

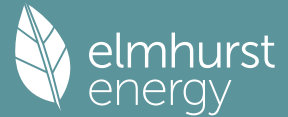
Total internal gains

783.1966 810.3243 772.7610 752.0590 711.4556 687.5765 659.6312 656.7912 677.4579 697.1162 738.9713 763.6319 (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
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Northeast			1.2600		11.2829		0.6300		0.7000		0.7700		4.3447 (75)
Southeast			26.5800		36.7938		0.6300		0.7000		0.7700		298.8834 (77)
Southwest			2.5200		36.7938		0.6300		0.7000		0.7700		28.3366 (79)
Northwest			13.0200		11.2829		0.6300		0.7000		0.7700		44.8957 (81)
Southeast			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Northwest			1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)

Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821	(83)
Total gains	1188.5514	1527.9428	1822.6582	2160.2588	2381.8796	2385.5902	2280.2843	2076.6033	1851.0673	1508.9729	1229.5363	1107.2141	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1784	44.2462	44.3128	44.6285	44.6880	44.9674	44.9674	45.0195	44.8594	44.6880	44.5677	44.4426	
alpha	3.9452	3.9497	3.9542	3.9752	3.9792	3.9978	3.9978	4.0013	3.9906	3.9792	3.9712	3.9628	
util living area	0.9955	0.9877	0.9690	0.9128	0.7975	0.6256	0.4744	0.5351	0.7774	0.9514	0.9903	0.9966	(86)
MIT	19.1043	19.3991	19.8080	20.3198	20.7125	20.9208	20.9795	20.9674	20.8086	20.2596	19.5791	19.0529	(87)
Th 2	20.1190	20.1202	20.1214	20.1271	20.1282	20.1331	20.1331	20.1340	20.1312	20.1282	20.1260	20.1238	(88)
util rest of house	0.9945	0.9851	0.9623	0.8941	0.7563	0.5568	0.3870	0.4444	0.7181	0.9373	0.9879	0.9959	(89)
MIT 2	18.3605	18.6544	19.0593	19.5579	19.9162	20.0878	20.1251	20.1203	20.0073	19.5100	18.8391	18.3127	(90)
Living area fraction	FLA = Living area / (4) =												
MIT	18.4314	18.7254	19.1306	19.6305	19.9920	20.1672	20.2065	20.2010	20.0837	19.5814	18.9096	18.3832	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.4314	18.7254	19.1306	19.6305	19.9920	20.1672	20.2065	20.2010	20.0837	19.5814	18.9096	18.3832	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9795	0.9527	0.8815	0.7492	0.5596	0.3947	0.4518	0.7144	0.9259	0.9831	0.9937	(94)
Useful gains	1178.8964	1496.6389	1736.3681	1904.3046	1784.4011	1335.0639	899.9229	938.1109	1322.4636	1397.2147	1208.7573	1100.2872	(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	3646.2550	3561.8396	3249.1355	2740.8140	2115.1618	1411.2661	914.2528	962.4316	1520.5094	2291.0155	3020.5709	3637.8722	(97)
Space heating kWh	1835.7148	1387.8149	1125.4990	602.2868	246.0859	0.0000	0.0000	0.0000	0.0000	664.9878	1304.5058	1887.9632	(98a)
Space heating requirement - total per year (kWh/year)	9054.8581												
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	1835.7148	1387.8149	1125.4990	602.2868	246.0859	0.0000	0.0000	0.0000	0.0000	664.9878	1304.5058	1887.9632	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	9054.8581												
Space heating per m2	(98c) / (4) = 33.5987 (99)												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2382.8855	1875.8886	1924.3579	0.0000	0.0000	0.0000	0.0000 (100)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8387	0.8986	0.8639	0.0000	0.0000	0.0000	0.0000 (101)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1998.6164	1685.6272	1662.4610	0.0000	0.0000	0.0000	0.0000 (102)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2640.5188	2523.8688	2296.4336	0.0000	0.0000	0.0000	0.0000 (103)	
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	462.1697	623.6517	471.6756	0.0000	0.0000	0.0000	0.0000 (104)	
Intermittency factor (Table 10b)	fc = cooled area / (4) =											1.0000 (105)	
0.2500	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	115.5424	155.9129	117.9189	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement													389.3743 (107)
Energy for space heating													33.5987 (99)
Energy for space cooling													1.4448 (108)
Total													35.0435 (109)
Fabric Energy Efficiency (TFEE)													35.0 (109)

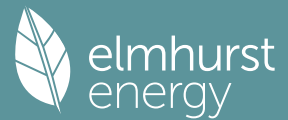
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)	
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800 (5)	

2. Ventilation rate

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											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											6 * 10 =	60.0000 (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) =										60.0000 / (5) =	0.0921 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000 (17)	
Infiltration rate											0.3421 (18)	
Number of sides sheltered											3 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2651 (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	0.3380	0.3314	0.3248	0.2916	0.2850	0.2519	0.2519	0.2452	0.2651	0.2850	0.2983	0.3115 (22b)
Effective ac	0.5571	0.5549	0.5527	0.5425	0.5406	0.5317	0.5317	0.5301	0.5351	0.5406	0.5445	0.5485 (25)

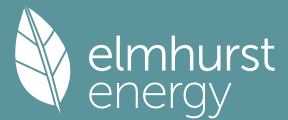
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m2)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496			(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		41037.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2709	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				30.0000	0.0500	1.5000		
E3 Sill				29.1000	0.0240	0.6984		
E4 Jamb				57.0000	0.0190	1.0830		
E5 Ground floor (normal)				54.4300	0.0410	2.2316		
R1 Head of roof window				3.6000	0.2400	0.8640		
R2 Sill of roof window				3.6000	0.2400	0.8640		
R3 Jamb of roof window				9.3600	0.2400	2.2464		
E6 Intermediate floor within a dwelling				54.4300	0.0200	1.0886		
E10 Eaves (insulation at ceiling level)				13.2000	0.0240	0.3168		
E11 Eaves (insulation at rafter level)				14.6000	0.0200	0.2920		
E12 Gable (insulation at ceiling level)				27.4000	0.0450	1.2330		
E13 Gable (insulation at rafter level)				2.6000	0.0550	0.1430		
E16 Corner (normal)				40.8600	0.0400	1.6344		
E17 Corner (inverted - internal area greater than external area)				20.3800	-0.0820	-1.6712		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5241	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	137.3737	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0923 (42)	
Hot water usage for mixer showers													
80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518 (42a)		
Hot water usage for baths													
32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772 (42b)		
Hot water usage for other uses													
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)		
Average daily hot water use (litres/day)												145.9086 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270 (44)	
Energy content	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554 (45)	
Energy content (annual)	Total = Sum(45)m =											2278.3713	
Distribution loss (46)m = 0.15 x (45)m													
	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433 (46)	

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Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(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	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(64)
Total per year (kWh/year) = Sum(64)m =												2964.2063 (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												
124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(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	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460 (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)												
	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912 (71)
Water heating gains (Table 5)												
	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431 (72)
Total internal gains												
	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast		1.2600		11.2829		0.6300		0.7000		0.7700		4.3447 (75)
Southeast		26.5800		36.7938		0.6300		0.7000		0.7700		298.8834 (77)
Southwest		2.5200		36.7938		0.6300		0.7000		0.7700		28.3366 (79)
Northwest		13.0200		11.2829		0.6300		0.7000		0.7700		44.8957 (81)
Southeast		1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Northwest		1.4000		26.0000		0.6300		0.7000		1.0000		14.4472 (82)
Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821 (83)
Total gains	1384.3977	1695.3655	1997.7557	2303.1386	2506.5089	2479.0816	2367.2743	2172.3974	1954.3350	1646.1716	1388.0148	1295.0952 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501
alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767
util living area												
	0.9923	0.9825	0.9586	0.8962	0.7748	0.6043	0.4558	0.5117	0.7519	0.9369	0.9853	0.9940 (86)
Living	19.5923	19.7985	20.1020	20.4616	20.7325	20.8716	20.9102	20.9028	20.7985	20.4223	19.9323	19.5532
Non living	18.4460	18.7095	19.0935	19.5415	19.8555	20.0027	20.0337	20.0305	19.9358	19.5037	18.8869	18.4005
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2799	19.7985	20.1020	20.4616	20.7325	20.8716	20.9102	20.9028	20.7985	20.4223	19.9323	19.7556 (87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275 (88)
util rest of house												
	0.9907	0.9789	0.9501	0.8751	0.7319	0.5366	0.3716	0.4241	0.6908	0.9195	0.9817	0.9928 (89)
MIT 2	19.4537	18.7095	19.0935	19.5415	19.8555	20.0027	20.0337	20.0305	19.9358	19.5037	18.8869	18.7117 (90)
Living area fraction									fLA = Living area / (4) =			0.0953 (91)
MIT	19.5324	18.8132	19.1896	19.6291	19.9390	20.0855	20.1173	20.1136	20.0180	19.5913	18.9865	18.8111 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5324	18.8132	19.1896	19.6291	19.9390	20.0855	20.1173	20.1136	20.0180	19.5913	18.9865	18.8111 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9894	0.9718	0.9387	0.8608	0.7214	0.5321	0.3694	0.4213	0.6815	0.9059	0.9752	0.9902 (94)
Useful gains	1369.6805	1647.6043	1875.2143	1982.5236	1808.1431	1319.1896	874.5372	915.3131	1331.8821	1491.2802	1353.6446	1282.4384 (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												
	3917.0238	3571.1689	3251.1599	2725.3175	2089.4157	1380.6234	885.2469	933.3522	1493.8352	2280.1833	3024.3044	3730.2214 (97)
Space heating kWh												
	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98a)
Space heating requirement - total per year (kWh/year)												8566.6106

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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	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8566.6106
Space heating per m2										(98c) / (4) =		31.7871 (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 %)												281.3248 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98)
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248 (210)
Space heating fuel (main heating system)	673.6780	459.4814	363.8866	190.1047	74.3862	0.0000	0.0000	0.0000	0.0000	208.6357	427.5751	647.3480 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater (217)m	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926 (216)
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3045.0957 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1926
Water heating fuel used												1663.4845 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												5041.4078 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3045.0957	16.4900	502.1363 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1663.4845	16.4900	274.3086 (247)	
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	332.8276	16.4900	54.8833 (250)	
Additional standing charges			0.0000 (251)	
Total energy cost			831.3281 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.9516 (257)
SAP value		84.5746
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	3045.0957	0.1558	474.4612	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	1663.4845	0.1409	234.4080	(264)
Space and water heating			708.8692	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	332.8276	0.1443	48.0373	(268)
Total CO ₂ , kg/year			756.9065	(272)
CO ₂ emissions per m ²			2.8100	(273)
EI value			96.7750	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Main dwelling				
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560	(1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 651.4800	(5)

2. Ventilation rate

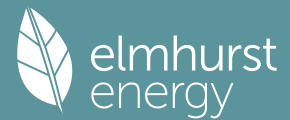
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	6 * 10 =	60.0000	(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) =	60.0000 / (5) =	0.0921	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000		(17)
Infiltration rate	0.3421		(18)
Number of sides sheltered	3		(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2651	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000	(22)
Wind factor	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250	(22a)
Adj infilt rate	0.2983	0.2850	0.2916	0.2585	0.2585	0.2254	0.2320	0.2254	0.2386	0.2585	0.2519	0.2718	(22b)
Effective ac	0.5445	0.5406	0.5425	0.5334	0.5334	0.5254	0.5269	0.5254	0.5285	0.5334	0.5317	0.5369	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Main dwelling								
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m ²)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496			(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								41037.0000 (34)
List of Thermal Bridges								152.2709 (35)
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				30.0000	0.0500		1.5000	
E3 Sill				29.1000	0.0240		0.6984	
E4 Jamb				57.0000	0.0190		1.0830	
E5 Ground floor (normal)				54.4300	0.0410		2.2316	
R1 Head of roof window				3.6000	0.2400		0.8640	
R2 Sill of roof window				3.6000	0.2400		0.8640	

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R3 Jamb of roof window	9.3600	0.2400	2.2464
E6 Intermediate floor within a dwelling	54.4300	0.0200	1.0886
E10 Eaves (insulation at ceiling level)	13.2000	0.0240	0.3168
E11 Eaves (insulation at rafter level)	14.6000	0.0200	0.2920
E12 Gable (insulation at ceiling level)	27.4000	0.0450	1.2330
E13 Gable (insulation at rafter level)	2.6000	0.0550	0.1430
E16 Corner (normal)	40.8600	0.0400	1.6344
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0820	-1.6712
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.5241 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	137.3737 (37)

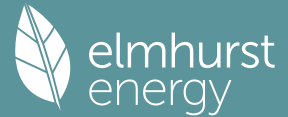
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	117.0572	116.2261	116.6369	114.6771	114.6771	112.9534	113.2792	112.9534	113.6145	114.6771	114.3135	115.4327 (38)
Average = Sum(39)m / 12 =	254.4309	253.5998	254.0106	252.0508	252.0508	250.3271	250.6529	250.3271	250.9882	252.0508	251.6872	252.8064 (39)
												252.0819
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9441	0.9410	0.9425	0.9353	0.9353	0.9289	0.9301	0.9289	0.9313	0.9353	0.9339	0.9381 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	0.9354
												31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.0923 (42)
Hot water usage for mixer showers												
	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518 (42a)
Hot water usage for baths												
	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772 (42b)
Hot water usage for other uses												
	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980 (42c)
Average daily hot water use (litres/day)												145.9086 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270 (44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m =
	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	2278.3713
Water storage loss (or HIU loss):												34.9433 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (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												
	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
												Total per year (kWh/year) = Sum(64)m =
												2964.2063 (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												
	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368 (66)
	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460 (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)												
	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912 (71)
Water heating gains (Table 5)												
	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431 (72)
Total internal gains												
	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131 (73)

6. Solar gains												
[Jan]		Area	Solar flux		g	FF		Access		Gains		
		m2	Table 6a		Specific data	Specific data		factor		W		
			W/m2		or Table 6b	or Table 6c		Table 6d				
Northeast		1.2600	12.9326		0.6300	0.7000		0.7700		4.9800 (75)		
Southeast		26.5800	40.6744		0.6300	0.7000		0.7700		330.4058 (77)		
Southwest		2.5200	40.6744		0.6300	0.7000		0.7700		31.3252 (79)		
Northwest		13.0200	12.9326		0.6300	0.7000		0.7700		51.4598 (81)		
Southeast		1.4000	30.0000		0.6300	0.7000		1.0000		16.6698 (82)		
Northwest		1.4000	30.0000		0.6300	0.7000		1.0000		16.6698 (82)		

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Solar gains	451.5103	733.1766	1065.4396	1458.0650	1696.0203	1844.8391	1725.1829	1524.6987	1267.0929	870.9446	559.9981	378.8922 (83)
Total gains	1430.5532	1710.9236	2013.2981	2353.0038	2532.1052	2625.9070	2471.8041	2277.2839	2047.8185	1705.2595	1457.4479	1330.4053 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.8026	44.9494	44.8767	45.2257	45.2257	45.5371	45.4779	45.5371	45.4171	45.2257	45.2910	45.0905
alpha	3.9868	3.9966	3.9918	4.0150	4.0150	4.0358	4.0319	4.0358	4.0278	4.0150	4.0194	4.0060
util living area	0.9909	0.9814	0.9534	0.8770	0.7393	0.5212	0.3610	0.4003	0.6868	0.9194	0.9812	0.9930 (86)
Living	19.6532	19.8360	20.1636	20.5294	20.7763	20.8968	20.9189	20.9167	20.8433	20.4986	20.0108	19.6195
Non living	18.5300	18.7643	19.1761	19.6274	19.9068	20.0275	20.0421	20.0422	19.9825	19.5999	18.9928	18.4910
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3110	19.8360	20.1636	20.5294	20.7763	20.8968	20.9189	20.9167	20.8433	20.4986	20.0108	19.8126 (87)
Th 2	20.1302	20.1328	20.1315	20.1376	20.1376	20.1430	20.1420	20.1430	20.1410	20.1376	20.1388	20.1353 (88)
util rest of house	0.9891	0.9777	0.9438	0.8524	0.6913	0.4505	0.2769	0.3105	0.6169	0.8974	0.9766	0.9915 (89)
MIT 2	19.4923	18.7643	19.1761	19.6274	19.9068	20.0275	20.0421	20.0422	19.9825	19.5999	18.9928	18.7873 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8550 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8850 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9876	0.9703	0.9318	0.8384	0.6823	0.4477	0.2753	0.3087	0.6101	0.8832	0.9691	0.9886 (94)
Useful gains	1412.8200	1660.1898	1876.0681	1972.6708	1727.6440	1175.5641	680.4102	702.9479	1249.4637	1506.0516	1412.4369	1315.2859 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	3834.3464	3516.5217	3142.1705	2599.4881	1938.1736	1204.1651	683.1837	707.3119	1346.4204	2163.9848	2942.1818	3636.6190 (97)
Space heating kWh	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98a)
Space heating requirement - total per year (kWh/year)												7916.9839
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	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7916.9839
Space heating per m2										(98c) / (4) =		29.3766 (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 %)												280.7686 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98)
Space heating efficiency (main heating system 1)	280.7686	280.7686	280.7686	280.7686	280.7686	0.0000	0.0000	0.0000	0.0000	280.7686	280.7686	280.7686 (210)
Space heating fuel (main heating system)	641.6727	444.3000	335.5005	160.7404	55.7876	0.0000	0.0000	0.0000	0.0000	174.3437	392.2861	615.1228 (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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater (217)m	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889 (216)
Fuel for water heating, kWh/month	163.8259	144.8693	153.8970	138.3977	134.3129	118.6458	113.5135	122.8103	123.0088	138.8361	147.9774	163.4246 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2819.7538 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1889
Water heating fuel used												1663.5193 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4816.1008 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2819.7538	28.4300	801.6560 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	28.4300	472.9385 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	28.4300	94.6229 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1369.2174 (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	2819.7538	0.1562	440.5730 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.5193	0.1409	234.4130 (264)
Space and water heating			674.9860 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Total CO2, kg/year			723.0233 (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	2819.7538	1.5784	4450.7350 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	1.5210	2530.2928 (278)
Space and water heating			6981.0279 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Total Primary energy kWh/year			7491.5300 (286)

SAP 10 EPC IMPROVEMENTS

00001

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

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.2	-£ 306	-144 kg (19.9%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 91	-39 kg (5.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£306	0.54 kg/m²	B 88 A 97
Total Savings	£306	0.54 kg/m²	

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 590 TEST (30 Jan 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1369	£1369	£0
Space heating	£802	£802	£0
Water heating	£473	£473	£0
Lighting	£95	£95	£0
Generated (PV)	-£0	-£306	£306
Total cost of fuels	£1369	£1063	£306
Total cost of uses	£1370	£1064	£306
Delivered energy	18 kWh/m²	14 kWh/m²	4 kWh/m²

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Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.1 tonnes
CO2 emissions per m ²	3 kg/m ²	2 kg/m ²	1 kg/m ²
Primary energy	28 kWh/m ²	22 kWh/m ²	6 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)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

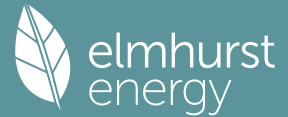
2. Ventilation rate

	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	6 * 10 = 60.0000 (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) =	60.0000 / (5) = 0.0921 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3421 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2651 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.3380 0.3314 0.3248 0.2916 0.2850 0.2519 0.2519 0.2452 0.2651 0.2850 0.2983 0.3115 (22b)
Effective ac	0.5571 0.5549 0.5527 0.5425 0.5406 0.5317 0.5317 0.5301 0.5351 0.5406 0.5445 0.5485 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			43.3800	1.3258	57.5114		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Opening Type 3			2.8000	1.2357	3.4601		(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000 (28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000 (29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000 (29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000 (30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100 (30)
Total net area of external elements Aum(A, m ²)			493.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	124.8496		(33)
Main dwelling							
Internal Wall 1			129.0000			75.0000	9675.0000 (32c)
Internal Wall 2			140.1100			9.0000	1260.9900 (32c)
Internal Floor 1			131.2000			18.0000	2361.6000 (32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	41037.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.2709 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				30.0000	0.0500	1.5000	
E3 Sill				29.1000	0.0240	0.6984	
E4 Jamb				57.0000	0.0190	1.0830	
E5 Ground floor (normal)				54.4300	0.0410	2.2316	
R1 Head of roof window				3.6000	0.2400	0.8640	
R2 Sill of roof window				3.6000	0.2400	0.8640	
R3 Jamb of roof window				9.3600	0.2400	2.2464	
E6 Intermediate floor within a dwelling				54.4300	0.0200	1.0886	
E10 Eaves (insulation at ceiling level)				13.2000	0.0240	0.3168	
E11 Eaves (insulation at rafter level)				14.6000	0.0200	0.2920	
E12 Gable (insulation at ceiling level)				27.4000	0.0450	1.2330	
E13 Gable (insulation at rafter level)				2.6000	0.0550	0.1430	
E16 Corner (normal)				40.8600	0.0400	1.6344	
E17 Corner (inverted - internal area greater than external area)				20.3800	-0.0820	-1.6712	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5241 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	137.3737 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	119.7774	119.3004	118.8329	116.6369	116.2261	114.3135	114.3135	113.9593	115.0502	116.2261	117.0572	117.9261	(38)
Heat transfer coeff	257.1511	256.6741	256.2066	254.0106	253.5998	251.6872	251.6872	251.3330	252.4239	253.5998	254.4309	255.2999	(39)
Average = Sum(39)m / 12 =												254.0087	
HLP	0.9542	0.9524	0.9507	0.9425	0.9410	0.9339	0.9339	0.9326	0.9366	0.9410	0.9441	0.9473	(40)
HLP (average)												0.9425	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers	80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	(42a)
Hot water usage for baths	32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	(42b)
Hot water usage for other uses	46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	(42c)
Average daily hot water use (litres/day)												145.9086	(43)
Daily hot water use	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy conte	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Energy content (annual)										Total = Sum(45)m =		2278.3713	
Distribution loss (46)m = 0.15 x (45)m	35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	(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	124.2946	110.4280	118.4120	108.3505	106.8088	96.6480	94.4857	99.9938	99.2330	109.4887	114.0263	124.0569	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

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

Metabolic gains (Table 5), Watts													
(66)m	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	(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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	(71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431	(72)
Total internal gains	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131	(73)

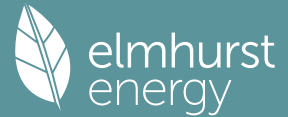
6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast		1.2600	11.2829	0.6300	0.7000	0.7700	4.3447 (75)						
Southeast		26.5800	36.7938	0.6300	0.7000	0.7700	298.8834 (77)						
Southwest		2.5200	36.7938	0.6300	0.7000	0.7700	28.3366 (79)						
Northwest		13.0200	11.2829	0.6300	0.7000	0.7700	44.8957 (81)						
Southeast		1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)						
Northwest		1.4000	26.0000	0.6300	0.7000	1.0000	14.4472 (82)						
Solar gains	405.3548	717.6184	1049.8972	1408.1998	1670.4240	1698.0137	1620.6531	1419.8122	1173.6094	811.8567	490.5650	343.5821	(83)
Total gains	1384.3977	1695.3655	1997.7557	2303.1386	2506.5089	2479.0816	2367.2743	2172.3974	1954.3350	1646.1716	1388.0148	1295.0952	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	44.3287	44.4111	44.4921	44.8767	44.9494	45.2910	45.2910	45.3548	45.1588	44.9494	44.8026	44.6501	

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alpha	3.9552	3.9607	3.9661	3.9918	3.9966	4.0194	4.0194	4.0237	4.0106	3.9966	3.9868	3.9767
util living area	0.9923	0.9825	0.9586	0.8962	0.7748	0.6043	0.4558	0.5117	0.7519	0.9369	0.9853	0.9940 (86)
Living	19.5923	19.7985	20.1020	20.4616	20.7325	20.8716	20.9102	20.9028	20.7985	20.4223	19.9323	19.5532
Non living	18.4460	18.7095	19.0935	19.5415	19.8555	20.0027	20.0337	20.0305	19.9358	19.5037	18.8869	18.4005
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2799	19.7985	20.1020	20.4616	20.7325	20.8716	20.9102	20.9028	20.7985	20.4223	19.9323	19.7556 (87)
Th 2	20.1217	20.1232	20.1246	20.1315	20.1328	20.1388	20.1388	20.1399	20.1365	20.1328	20.1302	20.1275 (88)
util rest of house	0.9907	0.9789	0.9501	0.8751	0.7319	0.5366	0.3716	0.4241	0.6908	0.9195	0.9817	0.9928 (89)
MIT 2	19.4537	18.7095	19.0935	19.5415	19.8555	20.0027	20.0337	20.0305	19.9358	19.5037	18.8869	18.7117 (90)
Living area fraction									fLA = Living area /	(4) =		0.0953 (91)
MIT	19.5324	18.8132	19.1896	19.6291	19.9390	20.0855	20.1173	20.1136	20.0180	19.5913	18.9865	18.8111 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5324	18.8132	19.1896	19.6291	19.9390	20.0855	20.1173	20.1136	20.0180	19.5913	18.9865	18.8111 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9894	0.9718	0.9387	0.8608	0.7214	0.5321	0.3694	0.4213	0.6815	0.9059	0.9752	0.9902 (94)
Useful gains	1369.6805	1647.6043	1875.2143	1982.5236	1808.1431	1319.1896	874.5372	915.3131	1331.8821	1491.2802	1353.6446	1282.4384 (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	3917.0238	3571.1689	3251.1599	2725.3175	2089.4157	1380.6234	885.2469	933.3522	1493.8352	2280.1833	3024.3044	3730.2214 (97)
Space heating kWh	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98a)
Space heating requirement - total per year (kWh/year)												8566.6106
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	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8566.6106
Space heating per m2										(98c) / (4) =		31.7871 (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 %)												281.3248 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1895.2234	1292.6354	1023.7035	534.8117	209.2668	0.0000	0.0000	0.0000	0.0000	586.9440	1202.8751	1821.1506 (98)
Space heating efficiency (main heating system 1)	281.3248	281.3248	281.3248	281.3248	281.3248	0.0000	0.0000	0.0000	0.0000	281.3248	281.3248	281.3248 (210)
Space heating fuel (main heating system)	673.6780	459.4814	363.8866	190.1047	74.3862	0.0000	0.0000	0.0000	0.0000	208.6357	427.5751	647.3480 (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	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater (217)m	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926	178.1926 (216)
Fuel for water heating, kWh/month	163.8225	144.8663	153.8938	138.3948	134.3101	118.6433	113.5111	122.8078	123.0063	138.8332	147.9743	163.4212 (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 (231)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 (231)
Lighting (232)a	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.4704	-63.4179	-98.1463	-116.4677	-128.2968	-117.4023	-115.4581	-106.1758	-89.8701	-73.9197	-46.8679	-35.1703 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3045.0957 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1926
Water heating fuel used												1663.4845 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1032.6633 (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												

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4008.7445 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3045.0957	16.4900	502.1363 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.4845	16.4900	274.3086 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	16.4900	54.8833 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1032.6633	16.4900	-170.2862
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-170.2862 (252)
Total energy cost			661.0420 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7567 (257)
SAP value		87.7343
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3045.0957	0.1558	474.4612 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.4845	0.1409	234.4080 (264)
Space and water heating			708.8692 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1032.6633	0.1338	-138.1358
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-138.1358 (269)
Total CO2, kg/year			618.7707 (272)
CO2 emissions per m2			2.3000 (273)
EI value			97.3636
EI rating			97 (274)
EI band			A

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

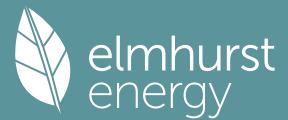
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	138.3000 (1b)	x 2.3200 (2b)	= 320.8560 (1b) - (3b)
First floor	131.2000 (1c)	x 2.5200 (2c)	= 330.6240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	269.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	651.4800 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	6 * 10 = 60.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	60.0000 / (5) = 0.0921 (8)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Yes
Pressure test	Blower Door
Pressure Test Method	5.0000 (17)
Measured/design AP50	0.3421 (18)
Infiltration rate	3 (19)
Number of sides sheltered	
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.2651 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.5000	4.3000	4.4000	3.9000	3.9000	3.4000	3.5000	3.4000	3.6000	3.9000	3.8000	4.1000	(22)
Adj infilt rate	1.1250	1.0750	1.1000	0.9750	0.9750	0.8500	0.8750	0.8500	0.9000	0.9750	0.9500	1.0250	(22a)
Effective ac	0.2983	0.2850	0.2916	0.2585	0.2585	0.2254	0.2320	0.2254	0.2386	0.2585	0.2519	0.2718	(22b)
	0.5445	0.5406	0.5425	0.5334	0.5334	0.5254	0.5269	0.5254	0.5285	0.5334	0.5317	0.5369	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			43.3800	1.3258	57.5114			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Opening Type 3			2.8000	1.2357	3.4601			(27a)
Heatloss Floor 1			138.3000	0.1100	15.2130	110.0000	15213.0000	(28a)
External Wall 1	207.9200	40.9500	166.9700	0.1800	30.0546	60.0000	10018.2000	(29a)
External Wall 2	4.6200	4.3200	0.3000	0.1400	0.0420	9.0000	2.7000	(29a)
External Roof 1	123.0000		123.0000	0.1100	13.5300	9.0000	1107.0000	(30)
External Roof 2	19.8900	2.8000	17.0900	0.1400	2.3926	9.0000	153.8100	(30)
Total net area of external elements Aum(A, m2)			493.7300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)... (30) + (32) =	124.8496		(33)
Main dwelling								
Internal Wall 1			129.0000			75.0000	9675.0000	(32c)
Internal Wall 2			140.1100			9.0000	1260.9900	(32c)
Internal Floor 1			131.2000			18.0000	2361.6000	(32d)
Internal Ceiling 1			138.3000			9.0000	1244.7000	(32e)

Heat capacity Cm = Sum(A x k)

(28)... (30) + (32) + (32a)... (32e) = 41037.0000 (34)

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

152.2709 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	30.0000	0.0500	1.5000
E3 Sill	29.1000	0.0240	0.6984
E4 Jamb	57.0000	0.0190	1.0830
E5 Ground floor (normal)	54.4300	0.0410	2.2316
R1 Head of roof window	3.6000	0.2400	0.8640
R2 Sill of roof window	3.6000	0.2400	0.8640
R3 Jamb of roof window	9.3600	0.2400	2.2464
E6 Intermediate floor within a dwelling	54.4300	0.0200	1.0886
E10 Eaves (insulation at ceiling level)	13.2000	0.0240	0.3168
E11 Eaves (insulation at rafter level)	14.6000	0.0200	0.2920
E12 Gable (insulation at ceiling level)	27.4000	0.0450	1.2330
E13 Gable (insulation at rafter level)	2.6000	0.0550	0.1430
E16 Corner (normal)	40.8600	0.0400	1.6344
E17 Corner (inverted - internal area greater than external area)	20.3800	-0.0820	-1.6712

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

12.5241 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 137.3737 (37)

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

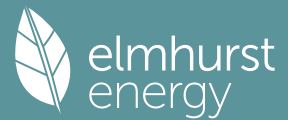
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	117.0572	116.2261	116.6369	114.6771	114.6771	112.9534	113.2792	112.9534	113.6145	114.6771	114.3135	115.4327	(38)
Average = Sum(39)m / 12 =	254.4309	253.5998	254.0106	252.0508	252.0508	250.3271	250.6529	250.3271	250.9882	252.0508	251.6872	252.0819	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9441	0.9410	0.9425	0.9353	0.9353	0.9289	0.9301	0.9289	0.9313	0.9353	0.9339	0.9381	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0923 (42)
Hot water usage for mixer showers													
80.3242	79.0945	77.2821	74.4941	71.9962	68.5016	65.7375	68.9688	70.5941	74.0553	77.6599	80.2518	80.2518	(42a)
Hot water usage for baths													
32.1027	31.6181	30.9286	29.8962	28.9658	27.6849	26.7131	27.9014	28.5251	29.7942	31.1137	32.0772	32.0772	(42b)
Hot water usage for other uses													
46.2980	44.6145	42.9309	41.2473	39.5638	37.8802	37.8802	39.5638	41.2473	42.9309	44.6145	46.2980	46.2980	(42c)
Average daily hot water use (litres/day)													145.9086 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.7249	155.3270	151.1417	145.6377	140.5257	134.0667	130.3309	136.4340	140.3665	146.7804	153.3881	158.6270	(44)
Energy content (annual)	233.6705	205.5290	215.9784	190.2392	181.0816	155.0436	144.0195	160.5854	162.8181	189.1414	207.3092	232.9554	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.0506	30.8294	32.3968	28.5359	27.1622	23.2565	21.6029	24.0878	24.4227	28.3712	31.0964	34.9433	34.9433	(46)
Water storage loss (or HIU loss):													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1286 (55)
Total storage loss													
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage													
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	291.2044	(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													
291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044	291.2044	(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)

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Heat gains from water heating, kWh/month
 124.2946 110.4280 118.4120 108.3505 106.8088 96.6480 94.4857 99.9938 99.2330 109.4887 114.0263 124.0569 (65)

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368	185.5368 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.1152	41.8473	34.0325	25.7648	19.2595	16.2597	17.5691	22.8370	30.6518	38.9195	45.4249	48.4247 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	646.3734	653.0808	636.1785	600.1956	554.7736	512.0834	483.5637	476.8563	493.7586	529.7415	575.1635	617.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460	56.6460 (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)	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912	-123.6912 (71)
Water heating gains (Table 5)	167.0627	164.3274	159.1559	150.4869	143.5603	134.2333	126.9969	134.4003	137.8236	147.1623	158.3699	166.7431 (72)
Total internal gains	979.0429	977.7470	947.8585	894.9388	836.0849	781.0679	746.6212	752.5852	780.7256	834.3149	897.4498	951.5131 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				1.2600	12.9326	0.6300	0.7000	0.7700	4.9800 (75)			
Southeast				26.5800	40.6744	0.6300	0.7000	0.7700	330.4058 (77)			
Southwest				2.5200	40.6744	0.6300	0.7000	0.7700	31.3252 (79)			
Northwest				13.0200	12.9326	0.6300	0.7000	0.7700	51.4598 (81)			
Southeast				1.4000	30.0000	0.6300	0.7000	1.0000	16.6698 (82)			
Northwest				1.4000	30.0000	0.6300	0.7000	1.0000	16.6698 (82)			
Solar gains	451.5103	733.1766	1065.4396	1458.0650	1696.0203	1844.8391	1725.1829	1267.0929	870.9446	559.9981	378.8922 (83)	
Total gains	1430.5532	1710.9236	2013.2981	2353.0038	2532.1052	2625.9070	2471.8041	2277.2839	2047.8185	1705.2595	1457.4479	1330.4053 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.8026	44.9494	44.8767	45.2257	45.2257	45.5371	45.4779	45.5371	45.4171	45.2257	45.2910	45.0905
alpha	3.9868	3.9966	3.9918	4.0150	4.0150	4.0358	4.0319	4.0358	4.0278	4.0150	4.0194	4.0060
util living area	0.9909	0.9814	0.9534	0.8770	0.7393	0.5212	0.3610	0.4003	0.6868	0.9194	0.9812	0.9930 (86)
Living	19.6532	19.8360	20.1636	20.5294	20.7763	20.8968	20.9189	20.9167	20.8433	20.4986	20.0108	19.6195
Non living	18.5300	18.7643	19.1761	19.6274	19.9068	20.0275	20.0421	20.0422	19.9825	19.5999	18.9928	18.4910
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3110	19.8360	20.1636	20.5294	20.7763	20.8968	20.9189	20.9167	20.8433	20.4986	20.0108	19.8126 (87)
Th 2	20.1302	20.1328	20.1315	20.1376	20.1376	20.1430	20.1420	20.1430	20.1410	20.1376	20.1388	20.1353 (88)
util rest of house	0.9891	0.9777	0.9438	0.8524	0.6913	0.4505	0.2769	0.3105	0.6169	0.8974	0.9766	0.9915 (89)
MIT 2	19.4923	18.7643	19.1761	19.6274	19.9068	20.0275	20.0421	20.0422	19.9825	19.5999	18.9928	18.7873 (90)
Living area fraction	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8850 (92)
MIT	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8850 (93)
Temperature adjustment	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8850 (93)
adjusted MIT	19.5703	18.8664	19.2702	19.7134	19.9896	20.1104	20.1256	20.1256	20.0645	19.6855	19.0898	18.8850 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9876	0.9703	0.9318	0.8384	0.6823	0.4477	0.2753	0.3087	0.6101	0.8832	0.9691	0.9886 (94)
Useful gains	1412.8200	1660.1898	1876.0681	1972.6708	1727.6440	1175.5641	680.4102	702.9479	1249.4637	1506.0516	1412.4369	1315.2859 (95)
Ext temp.	4.5000	5.0000	6.9000	9.4000	12.3000	15.3000	17.4000	17.3000	14.7000	11.1000	7.4000	4.5000 (96)
Heat loss rate W	3834.3464	3516.5217	3142.1705	2599.4881	1938.1736	1204.1651	683.1837	707.3119	1346.4204	2163.9848	2942.1818	3636.6190 (97)
Space heating kWh	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98a)
Space heating requirement - total per year (kWh/year)	7916.9839											
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	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	7916.9839											
Space heating per m ²	(98c) / (4) = 29.3766 (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 %)	280.7686 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	65.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1801.6157	1247.4550	941.9802	451.3085	156.6340	0.0000	0.0000	0.0000	0.0000	489.5023	1101.4163	1727.0718 (98)

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Space heating efficiency (main heating system 1)	280.7686	280.7686	280.7686	280.7686	0.0000	0.0000	0.0000	0.0000	280.7686	280.7686	280.7686	(210)
Space heating fuel (main heating system)	641.6727	444.3000	335.5005	160.7404	55.7876	0.0000	0.0000	0.0000	0.0000	174.3437	392.2861	615.1228 (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	(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	(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	(215)
Water heating												
Water heating requirement	291.9195	258.1410	274.2274	246.6092	239.3306	211.4136	202.2685	218.8344	219.1881	247.3904	263.6792	291.2044 (64)
Efficiency of water heater	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889	178.1889 (216)
Fuel for water heating, kWh/month	163.8259	144.8693	153.8970	138.3977	134.3129	118.6458	113.5135	122.8103	123.0088	138.8361	147.9774	163.4246 (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	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	41.2397	33.0840	29.7885	21.8243	16.8577	13.7729	15.3782	19.9891	25.9639	34.0660	38.4775	42.3858 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-45.9772	-64.9467	-99.2881	-118.6022	-128.4822	-123.7911	-120.1742	-111.4798	-95.2246	-78.0547	-52.8086	-38.6781 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2819.7538 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.1889
Water heating fuel used												1663.5193 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												332.8276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1077.5074 (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												3738.5934 (238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2819.7538	28.4300	801.6560 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	28.4300	472.9385 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	332.8276	28.4300	94.6229 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.5074	28.4300	-306.3353
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-306.3353 (252)
Total energy cost			1062.8821 (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	2819.7538	0.1562	440.5730 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1663.5193	0.1409	234.4130 (264)
Space and water heating			674.9860 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	332.8276	0.1443	48.0373 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.5074	0.1338	-144.1881
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-144.1881 (269)
Total CO2, kg/year			578.8352 (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	2819.7538	1.5784	4450.7350 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1663.5193	1.5210	2530.2928 (278)

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Space and water heating			6981.0279 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	332.8276	1.5338	510.5021 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1077.5074	1.4945	-1610.3533
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1610.3533 (283)
Total Primary energy kWh/year			5881.1767 (286)

APPENDIX B

WATER EFFICIENCY CALCULATIONS

Part G Compliance Report

PROJECT DETAILS

Project Reference:

Client:

Property: Adj 21 Danesbury Park Road
Welwyn
AL6 9SH

Local Authority:

Agent:

Assessor: Nicola Battista
Address: The Tower, Flete House, Ivybridge PL21 9NX
Contact: nicola@monitor-ec.co.uk
Software: G-Calc 2015 version 3.0.2
Prepared on: 11-Feb-26

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 5 bed dwelling, as designed, achieves a water consumption of **109.5** litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings

Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)	0	4.42	0.00	0
WC(dual flush)	Full flush vol.	0	1.46	0.00	0
	Part flush vol.	0	2.96	0.00	0
WC(multiple fittings)	Average effective Flush vol. (litres)	3.99	4.42	0.00	17.64
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	160	0.11	0.00	17.6
Shower (bath also present)	Flow rate (litres/min)	8.67	4.37	0.00	37.89
Bath only	Capacity to overflow (litres)		0.50	0.00	0
Shower only	Flow rate (litres/minute)		5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg dry load	7	2.1	0.0	14.7
Dishwasher	litres/place setting	1.25	3.6	0.0	4.5
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
Total calculated use (litres/person/day)					114.81
Contribution from greywater (litres/person/day)					-
Contribution from rainwater (litres/person/day)					-
Normalisation factor					0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)					104.5
External water use					5.0
Total Water Consumption. (36(1)) (litres/person/day)					109.5

Table 2: Consumption Calculator for multiple fittings for New Dwellings			
2.1: Taps (excluding kitchen sink taps)			
	Flow Rate (l/min)	Quantity (No.)	Total per fitting type
1 All Washbasins	5	4	20
2			
3			
4			
Total (Sum of all Quantities)		4	
Total (Sum of all totals per fitting type)			20
Average Flow Rate (l/min)			5
Maximum Flow Rate (l/min)			5
Proportionate flow Rate (l/min)			3.5

Table 2: Consumption Calculator for multiple fittings for New Dwellings			
2.3: Taps (kitchen/utility sink taps)			
	Flow Rate (l/min)	Quantity (No.)	Total per fitting type
1 Kitchen tap	6	1	6
2 Utility room tap	6	1	6
3			
4			
Total (Sum of all Quantities)		2	
Total (Sum of all totals per fitting type)			12
Average Flow Rate (l/min)			6
Maximum Flow Rate (l/min)			6
Proportionate flow Rate (l/min)			4.2

Table 2: Consumption Calculator for multiple fittings for New Dwellings			
2.6: Showers			
Shower Type	Flow rate (l/min)	Quantity (No.)	Total per fitting type
1 Bed 1 Ensuite	9	1	9
2 Bed 2 Ensuite	9	1	9
3 Bathroom	8	1	8
4			
Total (Sum of all Quantities)		3	
Total (Sum of all totals per fitting type)			26
Average Flow rate (l/min)			8.67
Maximum Flow rate (l/min)			9
Proportionate flow rate (l/min)			6.3

Table 2: Consumption Calculator for multiple fittings for New Dwellings			
2.7: WC's			
WC Type	Effective flushing volume (litres)	Quantity (No.)	Total per fitting type
1 All WCs	3.99	1	3.99
2			
3			
4			
Total (Sum of all Quantities)		1	
Total (Sum of all totals per fitting type)			3.99
Average effective flushing volume (litres)			3.99

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	All Washbasins	5 litres/min	4
Baths	Bathroom	160 litres to overflow	1
Dishwashers	TBA	1.25 litres/place	1
Washing Machines	TBA	7 litres/kg	1
Showers	Bed 1 Ensuite	9 litres/min	1
	Bed 2 Ensuite	9 litres/min	1
	Bathroom	8 litres/min	1
WC's	All WCs	6 / 3 litres flush vols.	1
Kitchen/Utility taps	Kitchen tap	6 litres/min	1
	Utility room tap	6 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer ().
The completed table should be returned to the assessor: Nicola Battista (Contact: nicola@monitor-ec.co.uk).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: - Adj 21 Danesbury Park Road

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: Signature: Date:

-----End of Report-----