

7. APPENDIX

A. SAP Calculations

i. Baseline

Full SAP Calculation Printout



Plot Reference	BASE/BELEAN/BEGREEN			Issued on Date	27/01/2026
Assessment Reference	Baseline main dwelling	Plot Type Ref	Flint House		
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD			SAP Version	10.2
SAP Rating	68 D	DER	6.03	TER	8.28
Environmental	93 A	% DER < TER			27.17
CO ₂ Emissions (t/year)	1.32	DFEE	55.93	TFEE	43.73
Compliance Check	See BREL	% DFEE < TFEE			-27.90
% DPER < TPER	-41.39	DPER	62.02	TPER	43.86
Assessor Details	Mr. Neil Bradford			Assessor ID	T704-0001
Client	Flint House, Joe Reader				

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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (5)

2. Ventilation rate

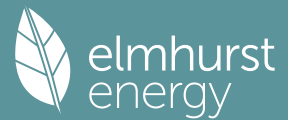
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3097 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3097 (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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (22b)
Effective ac	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.5918	5.3801		(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	157.1795		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

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

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	1.0000	40.2200
E3 Sill	40.2200	0.1000	4.0220
E4 Jamb	65.3800	0.1000	6.5380
E5 Ground floor (normal)	46.4800	0.3200	14.8736
E6 Intermediate floor within a dwelling	46.5100	0.1400	6.5114
E16 Corner (normal)	22.9200	0.1800	4.1256
R11 Upstands or kerbs of rooflights	12.3600	0.2400	2.9664
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			79.2570 (36)
Point Thermal Bridges			0.0000 (36a)
Total fabric heat loss			236.4365 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2179	122.8687	124.0354	125.2552	(38)
Heat transfer coeff	364.2904	363.6209	362.9646	359.8819	359.3051	356.6203	356.6203	356.1230	357.6544	359.3051	360.4719	361.6917	(39)
Average = Sum(39)m / 12 =												359.8791	
HLP	1.5475	1.5446	1.5418	1.5287	1.5263	1.5149	1.5149	1.5128	1.5193	1.5263	1.5313	1.5364	(40)
HLP (average)												1.5287	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)
Hot water usage for baths	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)
Average daily hot water use (litres/day)												141.2695	(43)
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2849	(44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	
Distribution loss (46)m = $0.15 \times (45)\text{m}$	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												1.5369	(55)
Total storage loss	47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446	(56)
If cylinder contains dedicated solar storage	47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446	(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130	(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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3243.2464	(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	143.9741	128.1550	137.8634	124.8849	123.6477	108.0817	108.2179	111.0822	110.7488	127.0224	131.1032	142.8470	(65)

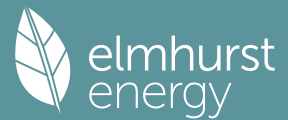
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	193.5136	190.7068	185.3003	173.4512	166.1932	150.1135	145.4541	149.3040	153.8177	170.7290	182.0877	191.9987	(72)
Total internal gains	872.3536	895.5439	857.7750	830.2449	787.8423	748.8937	719.6428	719.3050	741.1568	776.7491	823.2525	853.0322	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.1100	10.6334	0.6300	0.7000	0.7700	23.1054 (74)
East	21.7500	19.6403	0.6300	0.7000	0.7700	130.5505 (76)

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South			19.3500		46.7521		0.6300		0.7000		0.7700		276.4736 (78)
West			27.3600		19.6403		0.6300		0.7000		0.7700		164.2235 (80)
East			1.6900		26.6072		0.6300		0.7000		1.0000		17.8471 (82)
West			1.6900		26.6072		0.6300		0.7000		1.0000		17.8471 (82)

Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)
Total gains	1502.4007	2041.2955	2583.9173	3178.7348	3569.2966	3565.8253	3413.1273	3088.4281	2686.3746	2089.0838	1591.9451	1382.6863	(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	19.2745	19.3100	19.3449	19.5106	19.5420	19.6891	19.6891	19.7166	19.6322	19.5420	19.4787	19.4130	
alpha	2.2850	2.2873	2.2897	2.3007	2.3028	2.3126	2.3126	2.3144	2.3088	2.3028	2.2986	2.2942	
util living area	0.9689	0.9396	0.8895	0.7974	0.6739	0.5337	0.4152	0.4650	0.6677	0.8646	0.9500	0.9739	(86)
MIT	18.3229	18.7015	19.2348	19.8617	20.3498	20.6576	20.7837	20.7560	20.4942	19.7999	18.9354	18.2591	(87)
Th 2	19.6521	19.6542	19.6563	19.6660	19.6678	19.6764	19.6764	19.6779	19.6731	19.6678	19.6641	19.6603	(88)
util rest of house	0.9632	0.9291	0.8703	0.7626	0.6174	0.4494	0.3053	0.3522	0.5888	0.8325	0.9394	0.9692	(89)
MIT 2	16.5579	17.0355	17.7010	18.4674	19.0302	19.3591	19.4677	19.4521	19.2109	18.4200	17.3446	16.4819	(90)
Living area fraction										FLA = Living area / (4) =		0.2269	(91)
MIT	16.9585	17.4136	18.0491	18.7838	19.3296	19.6537	19.7664	19.7480	19.5021	18.7331	17.7056	16.8852	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9585	17.4136	18.0491	18.7838	19.3296	19.6537	19.7664	19.7480	19.5021	18.7331	17.7056	16.8852	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9467	0.9051	0.8409	0.7352	0.6013	0.4478	0.3132	0.3587	0.5771	0.8035	0.9175	0.9545	(94)
Useful gains	1422.2801	1847.4749	2172.8868	2336.9262	2146.0958	1596.8816	1069.1219	1107.8129	1550.3527	1678.6287	1460.6299	1319.8321	(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	4611.3553	4550.1979	4191.9054	3557.0109	2741.3653	1802.2693	1129.1878	1192.2950	1932.0939	2922.2622	3823.0081	4588.1207	(97)
Space heating kWh	2372.6720	1816.2299	1502.1499	878.4610	442.8805	0.0000	0.0000	0.0000	0.0000	925.2634	1700.9123	2431.6067	(98a)
Space heating requirement - total per year (kWh/year)												12070.1756	
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	2372.6720	1816.2299	1502.1499	878.4610	442.8805	0.0000	0.0000	0.0000	0.0000	925.2634	1700.9123	2431.6067	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12070.1756	
Space heating per m2										(98c) / (4) =		51.2730	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2372.6720	1816.2299	1502.1499	878.4610	442.8805	0.0000	0.0000	0.0000	0.0000	925.2634	1700.9123	2431.6067	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	1395.6894	1068.3705	883.6176	516.7418	260.5180	0.0000	0.0000	0.0000	0.0000	544.2726	1000.5367	1430.3569	(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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130	(64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	189.5311	167.8525	178.7204	157.8622	153.5711	134.4573	132.8065	137.8738	139.1757	159.5412	168.8632	187.5370	(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	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	(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												7100.1033	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	

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Water heating fuel used	1907.7920 (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)	341.3397 (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	9349.2350 (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	7100.1033	0.1550	1100.1629	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1907.7920	0.1410	269.0020	(264)
Space and water heating			1369.1649	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	341.3397	0.1443	49.2659	(268)
Total CO2, kg/year			1418.4308	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.0300	(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	7100.1033	1.5736	11173.0406	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1907.7920	1.5214	2902.4804	(278)
Space and water heating			14075.5210	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	341.3397	1.5338	523.5582	(282)
Total Primary energy kWh/year			14599.0792	(286)
Dwelling Primary energy Rate (DPER)			62.0200	(287)

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

1. Overall dwelling characteristics

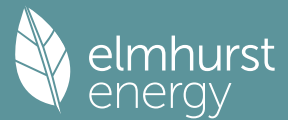
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800	(1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694	(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) =	0.0597 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3097 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3097 (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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (22b)
Effective ac	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (25)

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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 Opening Type			56.3500	1.1450	64.5229			(27)
TER Roof Light			2.5200	1.5918	5.0956			(27a)
GF			122.0000	0.1300	15.8600			(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152			(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284			(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496			(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756			(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983			(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959			(30)
Total net area of external elements Aum (A, m2)			536.2500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =	138.4415		(33)

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

107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0500	2.0110
E3 Sill	40.2200	0.0500	2.0110
E4 Jamb	65.3800	0.0500	3.2690
E5 Ground floor (normal)	46.4800	0.1600	7.4368
E6 Intermediate floor within a dwelling	46.5100	0.0000	0.0000
E16 Corner (normal)	22.9200	0.0900	2.0628
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888

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

17.7794 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 156.2209 (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	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2179	122.8687	124.0354	125.2552	(38)
Heat transfer coeff	284.0748	283.4053	282.7490	279.6663	279.0896	276.4047	276.4047	275.9075	277.4388	279.0896	280.2563	281.4761	(39)
Average = Sum(39)m / 12 =												279.6635	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2067	1.2039	1.2011	1.1880	1.1855	1.1741	1.1741	1.1720	1.1785	1.1855	1.1905	1.1957	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

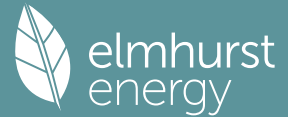
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)
Hot water usage for baths	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)
Average daily hot water use (litres/day)												141.2695	(43)
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2849	(44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	
Distribution loss (46)m = 0.15 x (45)m	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	294.3231	260.1675	275.9450	241.3853	233.1911	209.2411	205.7901	214.4046	217.2624	243.3403	260.0871	290.9333	(62)
WWHRS	-34.4351	-30.4547	-31.8904	-26.4065	-24.6099	-21.0589	-19.7393	-20.9908	-21.7883	-25.6860	-29.0991	-33.7974	(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	(64a)
Output from w/h	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2626.1147	(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	121.6704	108.0096	115.5597	103.3006	101.3440	92.6126	92.2332	95.0975	95.2797	104.7186	109.5189	120.5432	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	163.5355	160.7286	155.3221	143.4730	136.2150	128.6286	123.9693	127.8192	132.3329	140.7508	152.1096	162.0205	(72)

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Total internal gains
842.3755 865.5657 827.7969 800.2667 757.8641 727.4089 698.1580 697.8201 719.6720 746.7709 793.2743 823.0540 (73)

6. Solar gains

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

North				5.3000	10.6334	0.6300		0.7000		0.7700		17.2234 (74)
East				16.2300	19.6403	0.6300		0.7000		0.7700		97.4177 (76)
South				14.4300	46.7521	0.6300		0.7000		0.7700		206.1764 (78)
West				20.3900	19.6403	0.6300		0.7000		0.7700		122.3873 (80)
East				1.2600	26.6072	0.6300		0.7000		1.0000		13.3061 (82)
West				1.2600	26.6072	0.6300		0.7000		1.0000		13.3061 (82)

Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021	394.9560 (83)
Total gains	1312.1925	1719.9317	2114.9390	2551.4630	2831.8961	2827.8898	2706.5911	2464.3971	2170.1682	1725.3520	1366.4764	1218.0100 (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	24.7172	24.7756	24.8331	25.1068	25.1587	25.4031	25.4031	25.4489	25.3084	25.1587	25.0539	24.9454
alpha	2.6478	2.6517	2.6555	2.6738	2.6772	2.6935	2.6935	2.6966	2.6872	2.6772	2.6703	2.6630
util living area	0.9757	0.9518	0.9084	0.8209	0.6956	0.5451	0.4191	0.4693	0.6816	0.8818	0.9596	0.9798 (86)
MIT	18.1801	18.6158	19.2230	19.9438	20.4871	20.8129	20.9326	20.9074	20.6425	19.8678	18.8849	18.1114 (87)
Th 2	19.9146	19.9169	19.9191	19.9296	19.9316	19.9407	19.9407	19.9424	19.9372	19.9316	19.9276	19.9235 (88)
util rest of house	0.9717	0.9440	0.8937	0.7927	0.6483	0.4744	0.3285	0.3762	0.6156	0.8563	0.9518	0.9765 (89)
MIT 2	16.6128	17.1646	17.9263	18.8133	19.4461	19.7985	19.9046	19.8892	19.6383	18.7462	17.5180	16.5303 (90)
Living area fraction	16.9684	17.4939	18.2206	19.0698	19.6823	20.0287	20.1379	20.1203	19.8662	19.0007	17.8282	16.8891 (92)
MIT	16.9684	17.4939	18.2206	19.0698	19.6823	20.0287	20.1379	20.1203	19.8662	19.0007	17.8282	16.8891 (92)
Temperature adjustment	16.9684	17.4939	18.2206	19.0698	19.6823	20.0287	20.1379	20.1203	19.8662	19.0007	17.8282	16.8891 (93)
adjusted MIT	16.9684	17.4939	18.2206	19.0698	19.6823	20.0287	20.1379	20.1203	19.8662	19.0007	17.8282	16.8891 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9549	0.9197	0.8639	0.7660	0.6361	0.4806	0.3461	0.3927	0.6107	0.8282	0.9297	0.9617 (94)
Useful gains	1253.0414	1581.7355	1827.0124	1954.4860	1801.2947	1359.1288	936.6842	967.6939	1325.3228	1428.8648	1270.3986	1171.3627 (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	3598.7811	3569.1775	3313.9771	2844.1607	2227.7773	1500.5153	977.8853	1026.4500	1599.7659	2344.5406	3006.6320	3571.6681 (97)
Space heating kWh	1745.2303	1335.5610	1106.3018	640.5658	317.3031	0.0000	0.0000	0.0000	0.0000	681.2628	1250.0880	1785.8272 (98a)
Space heating requirement - total per year (kWh/year)												8862.1400
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	1745.2303	1335.5610	1106.3018	640.5658	317.3031	0.0000	0.0000	0.0000	0.0000	681.2628	1250.0880	1785.8272 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8862.1400
Space heating per m2										(98c) / (4) =		37.6456 (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	1745.2303	1335.5610	1106.3018	640.5658	317.3031	0.0000	0.0000	0.0000	0.0000	681.2628	1250.0880	1785.8272 (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)	1890.8237	1446.9784	1198.5935	694.0041	343.7736	0.0000	0.0000	0.0000	0.0000	738.0962	1354.3749	1934.8074 (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	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359 (64)
Efficiency of water heater (217)m	87.5206	87.3542	87.0261	86.3528	84.9978	79.8000	79.8000	79.8000	79.8000	86.4395	87.2651	79.8000 (216)
Fuel for water heating, kWh/month	296.9449	262.9673	280.4384	248.9541	245.3959	235.8174	233.1463	242.3732	244.9550	251.7995	264.6969	293.6779 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.3041	7.3041	7.0685	7.3041 (231)
Lighting	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-98.3357	-131.3023	-178.7761	-189.9062	-195.6573	-179.1549	-176.5667	-170.7699	-159.7637	-144.2435	-105.2937	-85.8686 (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)

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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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-80.2964	-165.2852	-322.2035	-475.2415	-620.4428	-613.8577	-523.6274	-388.8196	-233.7950	-106.2978	-63.8108	(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	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											9601.4518	(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											3101.1669	(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)											341.3397	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-6030.1557	(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											7099.8027	(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	9601.4518	0.2100	2016.3049	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3101.1669	0.2100	651.2450	(264)
Space and water heating			2667.5499	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	341.3397	0.1443	49.2659	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1815.6384	0.1358	-246.6011	
PV Unit electricity exported	-4214.5173	0.1264	-532.8271	
Total			-779.4282	(269)
Total CO2, kg/year			1949.3168	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.2800	(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	9601.4518	1.1300	10849.6405	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3101.1669	1.1300	3504.3186	(278)
Space and water heating			14353.9591	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	341.3397	1.5338	523.5582	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1815.6384	1.5020	-2727.1576	
PV Unit electricity exported	-4214.5173	0.4641	-1955.9374	
Total			-4683.0951	(283)
Total Primary energy kWh/year			10324.5231	(286)
Target Primary Energy Rate (TPER)			43.8600	(287)

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

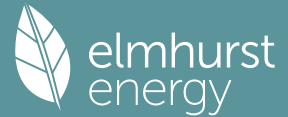
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)	
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	235.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 670.3694 (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)

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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) =	0.0597 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3097	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3097 (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	0.3948 0.3871 0.3793 0.3406 0.3329 0.2942 0.2942 0.2864 0.3097 0.3329 0.3484 0.3639	(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	0.5779 0.5749 0.5720 0.5580 0.5554 0.5433 0.5433 0.5410 0.5479 0.5554 0.5607 0.5662	(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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.5918	5.3801		(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		157.1795		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							107.3765 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				40.2200	1.0000	40.2200	
E3 Sill				40.2200	0.1000	4.0220	
E4 Jamb				65.3800	0.1000	6.5380	
E5 Ground floor (normal)				46.4800	0.3200	14.8736	
E6 Intermediate floor within a dwelling				46.5100	0.1400	6.5114	
E16 Corner (normal)				22.9200	0.1800	4.1256	
R11 Upstands or kerbs of rooflights				12.3600	0.2400	2.9664	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							79.2570 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	236.4365 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 127.8540 Feb 127.1844 Mar 126.5281 Apr 123.4454 May 122.8687 Jun 120.1838 Jul 120.1838 Aug 119.6866 Sep 121.2179 Oct 122.8687 Nov 124.0354 Dec 125.2552	(38)					
Heat transfer coeff	364.2904 363.6209 362.9646 359.8819 359.3051 356.6203 356.6203 356.1230 357.6544 359.3051 360.4719 361.6917	(39)					
Average = Sum(39)m / 12 =							359.8791
HLP	Jan 1.5475 Feb 1.5446 Mar 1.5418 Apr 1.5287 May 1.5263 Jun 1.5149 Jul 1.5149 Aug 1.5128 Sep 1.5193 Oct 1.5263 Nov 1.5313 Dec 1.5364	(40)					
HLP (average)							1.5287
Days in mont	31 28 31 30 31 30 31 31 30 31 30 31						

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (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												
32.5151 32.0322 31.3522 30.0983 29.1595 28.1185 27.5561 28.2314 28.9666 30.0806 31.3602 32.4052												(42b)
Hot water usage for other uses												
45.8442 44.1771 42.5101 40.8430 39.1759 37.5089 37.5089 39.1759 40.8430 42.5101 44.1771 45.8442												(42c)
Average daily hot water use (litres/day)												71.8231 (43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
Daily hot water use	78.3593 76.2093 73.8622 70.9414 68.3354 65.6273 65.0650 67.4073 69.8096 72.5906 75.5374 78.2494	(44)										
Energy conte	124.1019 108.5211 113.5235 97.1152 91.9926 80.6965 78.6905 83.4644 86.0823 98.5048 107.6168 122.5196	(45)										
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1192.8291
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):												
Total storage loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(56)										
If cylinder contains dedicated solar storage												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000												(57)
Primary loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(59)										
Combi loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(61)										
Total heat required for water heating calculated for each month												
105.4866 92.2429 96.4950 82.5479 78.1937 68.5920 66.8869 70.9447 73.1699 83.7291 91.4743 104.1416												(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)										

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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	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1013.9048 (64)
Electric shower(s)	60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221 (64a)
Heat gains from water heating, kWh/month	41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634	(72)
Total internal gains	731.5553	756.1490	721.6203	701.9031	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				7.1100	10.6334	0.6300	0.7000	0.7700	23.1054 (74)				
East				21.7500	19.6403	0.6300	0.7000	0.7700	130.5505 (76)				
South				19.3500	46.7521	0.6300	0.7000	0.7700	276.4736 (78)				
West				27.3600	19.6403	0.6300	0.7000	0.7700	164.2235 (80)				
East				1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)				
West				1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)				
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)
Total gains	1361.6024	1901.9006	2447.7626	3050.3931	3445.5510	3458.4271	3309.0473	2982.1358	2577.4101	1963.2108	1458.6146	1242.9510	(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	19.2745	19.3100	19.3449	19.5106	19.5420	19.6891	19.6891	19.7166	19.6322	19.5420	19.4787	19.4130	
alpha	2.2850	2.2873	2.2897	2.3007	2.3028	2.3126	2.3126	2.3144	2.3088	2.3028	2.2986	2.2942	
util living area	0.9744	0.9471	0.8992	0.8089	0.6865	0.5451	0.4257	0.4776	0.6825	0.8776	0.9577	0.9790	(86)
MIT	17.5142	18.0275	18.7524	19.6096	20.2801	20.7062	20.8813	20.8416	20.4763	19.5150	18.3393	17.4273	(87)
Th 2	19.6521	19.6542	19.6563	19.6660	19.6678	19.6764	19.6779	19.6731	19.6678	19.6678	19.6641	19.6603	(88)
util rest of house	0.9697	0.9377	0.8813	0.7752	0.6305	0.4602	0.3138	0.3630	0.6043	0.8476	0.9486	0.9751	(89)
MIT 2	16.5214	17.0275	17.7346	18.5536	19.1587	19.5145	19.6330	19.6151	19.3511	18.4924	17.3482	16.4403	(90)
Living area fraction	16.7467	17.2544	17.9656	18.7932	19.4132	19.7850	19.9163	19.8934	19.6064	18.7245	17.5731	16.6643	(91)
MIT	16.7467	17.2544	17.9656	18.7932	19.4132	19.7850	19.9163	19.8934	19.6064	18.7245	17.5731	16.6643	(92)
Temperature adjustment	16.7467	17.2544	17.9656	18.7932	19.4132	19.7850	19.9163	19.8934	19.6064	18.7245	17.5731	16.6643	(93)

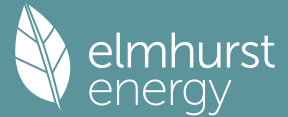
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9543	0.9142	0.8520	0.7489	0.6185	0.4678	0.3354	0.3832	0.5998	0.8201	0.9279	0.9618	(94)
Ext temp.	1299.4281	1738.6693	2085.5116	2284.3678	2130.9467	1617.7547	1109.8624	1142.6363	1545.9219	1610.0926	1353.4665	1195.4265	(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)
4534.1975	4492.3178	4161.5888	3560.3846	2771.3799	1849.0617	1182.6452	1244.0965	1969.4006	2919.1585	3775.2655	4508.2341		(97)
Space heating kWh	2406.6685	1850.4518	1544.6014	918.7321	476.4824	0.0000	0.0000	0.0000	0.0000	973.9450	1743.6953	2464.7289	(98a)
Space heating requirement - total per year (kWh/year)													12379.3053
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	2406.6685	1850.4518	1544.6014	918.7321	476.4824	0.0000	0.0000	0.0000	0.0000	973.9450	1743.6953	2464.7289	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													12379.3053
Space heating per m2													(98c) / (4) =
													52.5861 (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	3352.2304	2638.9899	2706.5352	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7494	0.8079	0.7701	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2512.1540	2131.9280	2084.2277	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3905.0179	3736.5388	3365.1785	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	1002.8621	1193.8305	953.0274	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	250.7155	298.4576	238.2569	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												787.4300	(107)
Energy for space heating												52.5861	(99)
Energy for space cooling												3.3449	(108)
Total												55.9311	(109)
Fabric Energy Efficiency (DFEE)												55.9	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3097 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3097 (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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (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	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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							
TER Opening Type			56.3500	1.1450	64.5229		(27)
TER Roof Light			2.5200	1.5918	5.0956		(27a)
GF			122.0000	0.1300	15.8600		(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152		(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284		(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496		(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756		(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983		(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959		(30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		138.4415		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							107.3765 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				40.2200	0.0500	2.0110	
E3 Sill				40.2200	0.0500	2.0110	
E4 Jamb				65.3800	0.0500	3.2690	
E5 Ground floor (normal)				46.4800	0.1600	7.4368	
E6 Intermediate floor within a dwelling				46.5100	0.0000	0.0000	
E16 Corner (normal)				22.9200	0.0900	2.0628	
R11 Upstands or kerbs of rooflights				12.3600	0.0800	0.9888	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.7794 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	156.2209 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 127.8540	Feb 127.1844	Mar 126.5281	Apr 123.4454	May 122.8687	Jun 120.1838	Jul 120.1838	Aug 119.6866	Sep 121.2179	Oct 122.8687	Nov 124.0354	Dec 125.2552 (38)
Heat transfer coeff	284.0748	283.4053	282.7490	279.6663	279.0896	276.4047	276.4047	275.9075	277.4388	279.0896	280.2563	281.4761 (39)
Average = Sum(39)m / 12 =												279.6635

HLP	Jan 1.2067	Feb 1.2039	Mar 1.2011	Apr 1.1880	May 1.1855	Jun 1.1741	Jul 1.1741	Aug 1.1720	Sep 1.1785	Oct 1.1855	Nov 1.1905	Dec 1.1957 (40)
HLP (average)												1.1880
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (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	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
Average daily hot water use (litres/day)												71.8231 (43)
Daily hot water use	Jan 78.3593	Feb 76.2093	Mar 73.8622	Apr 70.9414	May 68.3354	Jun 65.6273	Jul 65.0650	Aug 67.4073	Sep 69.8096	Oct 72.5906	Nov 75.5374	Dec 78.2494 (44)
Energy conte	124.1019	108.5211	113.5235	97.1152	91.9926	80.6965	78.6905	83.4644	86.0823	98.5048	107.6168	122.5196 (45)
Energy content (annual)										Total = Sum(45)m =		1192.8291
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):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1013.9048 (64)
Electric shower(s)	60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221 (64a)
Heat gains from water heating, kWh/month	41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 686.1607 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398 (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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634 (72)
Total internal gains	731.5553	756.1490	721.6203	701.9031	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				5.3000	10.6334		0.6300		0.7000		0.7700		17.2234 (74)
East				16.2300	19.6403		0.6300		0.7000		0.7700		97.4177 (76)
South				14.4300	46.7521		0.6300		0.7000		0.7700		206.1764 (78)
West				20.3900	19.6403		0.6300		0.7000		0.7700		122.3873 (80)
East				1.2600	26.6072		0.6300		0.7000		1.0000		13.3061 (82)
West				1.2600	26.6072		0.6300		0.7000		1.0000		13.3061 (82)
Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021		394.9560 (83)
Total gains	1201.3723	1610.5150	2008.7624	2453.0994	2738.1287	2741.9765	2623.9959	2379.5897	2082.6885	1629.4571	1263.1241		1108.2529 (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	24.7172	24.7756	24.8331	25.1068	25.1587	25.4031	25.4031	25.4489	25.3084	25.1587	25.0539	24.9454
alpha	2.6478	2.6517	2.6555	2.6738	2.6772	2.6935	2.6935	2.6966	2.6872	2.6772	2.6703	2.6630
util living area	0.9802	0.9582	0.9172	0.8321	0.7083	0.5575	0.4302	0.4827	0.6974	0.8938	0.9661	0.9839 (86)

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MIT	18.0965	18.5394	19.1588	19.9002	20.4622	20.8022	20.9281	20.9007	20.6205	19.8145	18.8104	18.0272 (87)
Th 2	19.9146	19.9169	19.9191	19.9296	19.9316	19.9407	19.9407	19.9424	19.9372	19.9316	19.9276	19.9235 (88)
util rest of house	0.9769	0.9513	0.9036	0.8050	0.6615	0.4862	0.3379	0.3879	0.6321	0.8702	0.9594	0.9811 (89)
MIT 2	17.2588	17.6974	18.3050	19.0205	19.5331	19.8230	19.9106	19.8977	19.6882	18.9590	17.9771	17.1958 (90)
Living area fraction									fLA = Living area / (4) =			0.2269 (91)
MIT	17.4489	17.8885	18.4987	19.2201	19.7439	20.0452	20.1415	20.1253	19.8997	19.1531	18.1662	17.3844 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4489	17.8885	18.4987	19.2201	19.7439	20.0452	20.1415	20.1253	19.8997	19.1531	18.1662	17.3844 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9658	0.9339	0.8811	0.7840	0.6524	0.4937	0.3562	0.4052	0.6295	0.8486	0.9441	0.9716	(94)
Useful gains	1160.2859	1504.1337	1769.8561	1923.1350	1786.4649	1353.6098	934.6159	964.2897	1311.0330	1382.8129	1192.4960	1076.7696	(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	3735.2789	3681.0038	3392.6336	2886.1813	2244.9762	1505.0772	978.8774	1027.8478	1609.0743	2387.0905	3101.3775	3711.1019	(97)
Space heating kWh	1915.7948	1462.8567	1207.3465	693.3934	341.1325	0.0000	0.0000	0.0000	0.0000	747.1825	1374.3947	1959.9433	(98a)
Space heating requirement - total per year (kWh/year)												9702.0443	
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	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1915.7948	1462.8567	1207.3465	693.3934	341.1325	0.0000	0.0000	0.0000	0.0000	747.1825	1374.3947	1959.9433	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9702.0443	
Space heating per m2											(98c) / (4) =	41.2134	(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	2598.2038	2045.3944	2096.8966	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7878	0.8454	0.8105	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2046.7916	1729.2090	1699.5684	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3078.4262	2946.0640	2669.4576	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	742.7769	905.3401	721.5975	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													
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	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	185.6942	226.3350	180.3994	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													592.4286 (107)
Energy for space heating													41.2134 (99)
Energy for space cooling													2.5166 (108)
Total													43.7300 (109)
Fabric Energy Efficiency (TFEE)													43.7 (109)

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

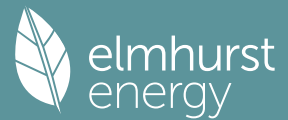
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (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)	
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0597 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3097	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3097	(21)

Full SAP Calculation Printout



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													
Effective ac	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639	(22b)
	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(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								
Windows			75.5700	1.1450	86.5305			(27)
Rooflights			3.3800	1.5918	5.3801			(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000	(28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400	(29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400	(29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800	(29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600	(29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300	(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100	(30)
Total net area of external elements Aum(A, m2)			536.2500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	157.1795		(33)
Main dwelling								
GF			169.3300			9.0000	1523.9700	(32c)
1ST MASTER			37.7600			9.0000	339.8400	(32c)
1ST BEDROOM			107.2800			9.0000	965.5200	(32c)
1ST LAND			148.6600			9.0000	1337.9400	(32c)
FF			113.4100			18.0000	2041.3800	(32d)
GF			113.4100			9.0000	1020.6900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	1.0000	40.2200
E3 Sill	40.2200	0.1000	4.0220
E4 Jamb	65.3800	0.1000	6.5380
E5 Ground floor (normal)	46.4800	0.3200	14.8736
E6 Intermediate floor within a dwelling	46.5100	0.1400	6.5114
E6 Corner (normal)	22.9200	0.1800	4.1256
R11 Upstands or kerbs of rooflights	12.3600	0.2400	2.9664

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 79.2570 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 236.4365 (37)

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

(38)m	Jan 127.8540	Feb 127.1844	Mar 126.5281	Apr 123.4454	May 122.8687	Jun 120.1838	Jul 120.1838	Aug 119.6866	Sep 121.2179	Oct 122.8687	Nov 124.0354	Dec 125.2552	(38)
Heat transfer coeff	364.2904	363.6209	362.9646	359.8819	359.3051	356.6203	356.6203	356.1230	357.6544	359.3051	360.4719	361.6917	(39)
Average = Sum(39)m / 12 =												359.8791	

HLP	Jan 1.5475	Feb 1.5446	Mar 1.5418	Apr 1.5287	May 1.5263	Jun 1.5149	Jul 1.5149	Aug 1.5128	Sep 1.5193	Oct 1.5263	Nov 1.5313	Dec 1.5364	(40)
HLP (average)												1.5287	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480	(42)
Hot water usage for mixer showers	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)
Hot water usage for baths	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)
Average daily hot water use (litres/day)												141.2695	(43)

Daily hot water use	Jan 153.6835	Feb 150.4015	Mar 146.4049	Apr 140.3280	May 135.3930	Jun 130.0876	Jul 128.0489	Aug 132.0282	Sep 136.2250	Oct 141.7948	Nov 147.9654	Dec 153.2849	(44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	

Distribution loss (46)m = 0.15 x (45)m 36.5096 32.1255 33.7528 28.8153 27.3398 23.9937 23.2296 24.5218 25.1969 28.8621 31.6206 36.0011 (46)

Water storage loss (or HIU loss):
 Store volume 200.0000 (47)

b) If manufacturer declared loss factor is not known :
 Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
 Volume factor from Table 2a 0.8434 (52)
 Temperature factor from Table 2b 0.6000 (53)
 Enter (49) or (54) in (55) 1.5369 (55)

Total storage loss 47.6446 43.0338 47.6446 46.1077 47.6446 46.1077 47.6446 47.6446 46.1077 47.6446 46.1077 47.6446 (56)

If cylinder contains dedicated solar storage 47.6446 43.0338 47.6446 46.1077 47.6446 46.1077 47.6446 47.6446 46.1077 47.6446 46.1077 47.6446 (57)

Primary loss 31.1612 28.1456 31.1612 30.1560 31.1612 22.5120 23.2624 23.2624 22.5120 31.1612 30.1560 31.1612 (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 322.2028 285.3492 303.8247 268.3657 261.0708 228.5775 225.7710 234.3855 236.5987 271.2200 287.0674 318.8130 (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)

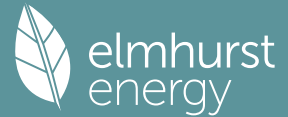
Output from w/h 322.2028 285.3492 303.8247 268.3657 261.0708 228.5775 225.7710 234.3855 236.5987 271.2200 287.0674 318.8130 (64)

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 143.9741 128.1550 137.8634 124.8849 123.6477 108.0817 108.2179 111.0822 110.7488 127.0224 131.1032 142.8470 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.3202	42.9175	34.9029	26.4237	19.7521	16.6755	18.0185	23.4211	31.4358	39.9149	46.5866	49.6631 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5895	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	193.5136	190.7068	185.3003	173.4512	166.1932	150.1135	145.4541	149.3040	153.8177	170.7290	182.0877	191.9987 (72)
Total internal gains	964.4679	962.5089	933.3369	879.4771	823.2198	761.2816	731.3884	734.3905	762.6697	824.5917	884.9497	937.7192 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				7.1100	10.6334	0.6300	0.7000	0.7700	23.1054 (74)				
East				21.7500	19.6403	0.6300	0.7000	0.7700	130.5505 (76)				
South				19.3500	46.7521	0.6300	0.7000	0.7700	276.4736 (78)				
West				27.3600	19.6403	0.6300	0.7000	0.7700	164.2235 (80)				
East				1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)				
West				1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)				
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)
Total gains	1594.5150	2108.2605	2659.4792	3227.9670	3604.6742	3578.2132	3424.8729	3103.5137	2707.8875	2136.9264	1653.6423	1467.3733	(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	19.2745	19.3100	19.3449	19.5106	19.5420	19.6891	19.6891	19.7166	19.6322	19.5420	19.4787	19.4130
alpha	2.2850	2.2873	2.2897	2.3007	2.3028	2.3126	2.3126	2.3144	2.3088	2.3028	2.2986	2.2942
util living area	0.9650	0.9359	0.8841	0.7930	0.6704	0.5324	0.4140	0.4633	0.6648	0.8596	0.9462	0.9706 (86)
MIT	18.3686	18.7318	19.2638	19.8756	20.3560	20.6587	20.7842	20.7569	20.4979	19.8169	18.9644	18.3019 (87)
Th 2	19.6521	19.6542	19.6563	19.6660	19.6678	19.6764	19.6764	19.6779	19.6731	19.6678	19.6641	19.6603 (88)
util rest of house	0.9587	0.9248	0.8642	0.7578	0.6138	0.4482	0.3043	0.3507	0.5858	0.8267	0.9350	0.9653 (89)
MIT 2	16.6154	17.0731	17.7360	18.4830	19.0363	19.3599	19.4680	19.4526	19.2142	18.4395	17.3804	16.5359 (90)
Living area fraction	17.0132	17.4495	18.0827	18.7990	19.3358	19.6547	19.7667	19.7486	19.5055	18.7520	17.7399	16.9367 (92)
MIT	17.0132	17.4495	18.0827	18.7990	19.3358	19.6547	19.7667	19.7486	19.5055	18.7520	17.7399	16.9367 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0132	17.4495	18.0827	18.7990	19.3358	19.6547	19.7667	19.7486	19.5055	18.7520	17.7399	16.9367 (93)

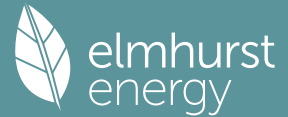
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9409	0.9001	0.8346	0.7306	0.5979	0.4467	0.3123	0.3573	0.5744	0.7978	0.9123	0.9495 (94)
Useful gains	1500.2158	1897.6995	2219.4938	2358.3656	2155.1676	1598.2997	1069.6086	1108.7347	1555.2947	1704.8288	1508.5751	1393.1998 (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	4631.3122	4563.2580	4204.0972	3562.4820	2743.5662	1802.5948	1129.2996	1192.5072	1933.2883	2929.0658	3835.3737	4606.7455 (97)
Space heating kWh	2329.5357	1791.2553	1476.5449	866.9638	437.7686	0.0000	0.0000	0.0000	0.0000	910.8323	1675.2950	2390.8780 (98a)
Space heating requirement - total per year (kWh/year)												11879.0737
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	2329.5357	1791.2553	1476.5449	866.9638	437.7686	0.0000	0.0000	0.0000	0.0000	910.8323	1675.2950	2390.8780 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11879.0737
Space heating per m2										(98c) / (4) =		50.4612 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	2329.5357	1791.2553	1476.5449	866.9638	437.7686	0.0000	0.0000	0.0000	0.0000	910.8323	1675.2950	2390.8780 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	1370.3151	1053.6796	868.5558	509.9787	257.5109	0.0000	0.0000	0.0000	0.0000	535.7837	985.4676	1406.3988 (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)

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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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130	(64)
Efficiency of water heater												170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	189.5311	167.8525	178.7204	157.8622	153.5711	134.4573	132.8065	137.8738	139.1757	159.5412	168.8632	187.5370	(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	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	(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												6987.6904	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1907.7920	(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)												341.3397	(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												9236.8221	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6987.6904	16.4900	1152.2701	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1907.7920	16.4900	314.5949	(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	341.3397	16.4900	56.2869	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1523.1520	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.9555	(257)
SAP value		68.3018	
SAP rating (Section 12)		68	(258)
SAP band		D	

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	6987.6904	0.1549	1082.6728	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1907.7920	0.1410	269.0020	(264)
Space and water heating			1351.6748	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	341.3397	0.1443	49.2659	(268)
Total CO2, kg/year			1400.9407	(272)
CO2 emissions per m2			5.9500	(273)
EI value			93.3053	
EI rating			93	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3097 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3097 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.3406	0.3329	0.3329	0.2942	0.2942	0.2555	0.2555	0.2632	0.2632	0.2864	0.2942	0.3097 (22b)
Effective ac	0.5580	0.5554	0.5554	0.5433	0.5433	0.5326	0.5326	0.5346	0.5346	0.5410	0.5433	0.5479 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.5918	5.3801		(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		157.1795		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	1.0000	40.2200
E3 Sill	40.2200	0.1000	4.0220
E4 Jamb	65.3800	0.1000	6.5380
E5 Ground floor (normal)	46.4800	0.3200	14.8736
E6 Intermediate floor within a dwelling	46.5100	0.1400	6.5114
E16 Corner (normal)	22.9200	0.1800	4.1256
R11 Upstands or kerbs of rooflights	12.3600	0.2400	2.9664

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 236.4365 (37)

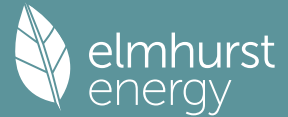
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m
Heat transfer coeff
Average = Sum(39)m / 12 =

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5287	1.5263	1.5263	1.5149	1.5149	1.5049	1.5049	1.5068	1.5068	1.5128	1.5149	1.5193 (40)
HLP (average)												1.5151
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

											3.0480 (42)
Assumed occupancy											
Hot water usage for mixer showers											
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)
Hot water usage for baths											

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Hot water usage for other uses	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)
Average daily hot water use (litres/day)	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
												141.2695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2849 (44)
Distribution loss (46)m = 0.15 x (45)m	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Water storage loss (or HIU loss):	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												0.8434 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.5369 (55)
Total storage loss	47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446 (56)
If cylinder contains dedicated solar storage	47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130 (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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130 (64)
												Total per year (kWh/year) = Sum(64)m = 3243.2464 (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	143.9741	128.1550	137.8634	124.8849	123.6477	108.0817	108.2179	111.0822	110.7488	127.0224	131.1032	142.8470 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.3202	42.9175	34.9029	26.4237	19.7521	16.6755	18.0185	23.4211	31.4358	39.9149	46.5866	49.6631 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5895	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	193.5136	190.7068	185.3003	173.4512	166.1932	150.1135	145.4541	149.3040	153.8177	170.7290	182.0877	191.9987 (72)
Total internal gains	964.4679	962.5089	933.3369	879.4771	823.2198	761.2816	731.3884	734.3905	762.6697	824.5917	884.9497	937.7192 (73)

6. Solar gains

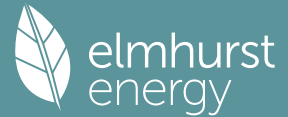
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.1100	12.0539		0.6300		0.7000		0.7700		26.1920 (74)
East				21.7500	22.4175		0.6300		0.7000		0.7700		149.0108 (76)
South				19.3500	51.7504		0.6300		0.7000		0.7700		306.0318 (78)
West				27.3600	22.4175		0.6300		0.7000		0.7700		187.4453 (80)
East				1.6900	30.5425		0.6300		0.7000		1.0000		20.4867 (82)
West				1.6900	30.5425		0.6300		0.7000		1.0000		20.4867 (82)
Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271	590.7272	(83)
Total gains	1674.1212	2165.7019	2715.4235	3350.1891	3678.0448	3793.3005	3599.1421	3269.0187	2858.2136	2264.9036	1772.0768	1528.4464	(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	19.5106	19.5420	19.5420	19.6891	19.6891	19.8199	19.8199	19.7951	19.7951	19.7166	19.6891	19.6322
alpha	2.3007	2.3028	2.3028	2.3126	2.3126	2.3213	2.3213	2.3197	2.3197	2.3144	2.3126	2.3088
util living area	0.9604	0.9307	0.8735	0.7678	0.6369	0.4666	0.3331	0.3625	0.6032	0.8305	0.9359	0.9673 (86)
MIT	18.4744	18.8227	19.3775	19.9999	20.4463	20.7298	20.8260	20.8173	20.6042	19.9748	19.0970	18.3970 (87)
Th 2	19.6660	19.6678	19.6678	19.6764	19.6764	19.6838	19.6838	19.6824	19.6824	19.6779	19.6764	19.6731 (88)
util rest of house	0.9533	0.9188	0.8518	0.7288	0.5753	0.3773	0.2193	0.2403	0.5138	0.7909	0.9226	0.9614 (89)
MIT 2	16.7575	17.1956	17.8839	18.6362	19.1406	19.4283	19.5011	19.4964	19.3256	18.6340	17.5540	16.6641 (90)
Living area fraction	17.1471	17.5648	18.2228	18.9456	19.4369	19.7236	19.8017	19.7961	19.6158	18.9383	17.9042	17.0574 (91)
MIT	17.1471	17.5648	18.2228	18.9456	19.4369	19.7236	19.8017	19.7961	19.6158	18.9383	17.9042	17.0574 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1471	17.5648	18.2228	18.9456	19.4369	19.7236	19.8017	19.7961	19.6158	18.9383	17.9042	17.0574 (93)

8. Space heating requirement

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Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9343	0.8934	0.8221	0.7037	0.5629	0.3802	0.2300	0.2514	0.5087	0.7634	0.8981	0.9445	(94)
Useful gains	1564.0733	1934.8779	2232.4214	2357.4652	2070.3678	1442.3636	827.8110	821.9792	1453.9137	1728.9519	1591.5878	1443.5799	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	4551.4646	4478.6801	4068.3424	3404.1566	2545.1691	1567.1479	850.8457	849.9391	1708.2053	2755.7710	3745.9934	4526.9607	(97)
Space heating kWh	2222.6191	1709.4351	1365.9252	753.6178	353.2522	0.0000	0.0000	0.0000	0.0000	763.9534	1551.1720	2294.0353	(98a)
Space heating requirement - total per year (kWh/year)												11014.0101	
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	2222.6191	1709.4351	1365.9252	753.6178	353.2522	0.0000	0.0000	0.0000	0.0000	763.9534	1551.1720	2294.0353	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11014.0101	
Space heating per m2										(98c) / (4) =		46.7865	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													170.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	2222.6191	1709.4351	1365.9252	753.6178	353.2522	0.0000	0.0000	0.0000	0.0000	763.9534	1551.1720	2294.0353	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	1307.4230	1005.5501	803.4854	443.3046	207.7954	0.0000	0.0000	0.0000	0.0000	449.3843	912.4541	1349.4325	(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	322.2028	285.3492	303.8247	268.3657	261.0708	228.5775	225.7710	234.3855	236.5987	271.2200	287.0674	318.8130	(64)	
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	189.5311	167.8525	178.7204	157.8622	153.5711	134.4573	132.8065	137.8738	139.1757	159.5412	168.8632	187.5370	(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	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												6478.8295	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												170.0000		
Water heating fuel used												1907.7920	(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)												341.3397	(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												8727.9612	(238)	

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6478.8295	28.4300	1841.9312	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1907.7920	28.4300	542.3853	(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	341.3397	28.4300	97.0429	(250)
Additional standing charges			0.0000	(251)
Total energy cost			2481.3594	(255)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6478.8295	0.1554	1006.6071 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1907.7920	0.1410	269.0020 (264)
Space and water heating			1275.6092 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	341.3397	0.1443	49.2659 (268)
Total CO2, kg/year			1324.8750 (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	6478.8295	1.5752	10205.4132 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1907.7920	1.5214	2902.4804 (278)
Space and water heating			13107.8936 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	341.3397	1.5338	523.5582 (282)
Total Primary energy kWh/year			13631.4518 (286)

SAP 10 EPC IMPROVEMENTS

Baseline main dwelling

Current energy efficiency rating:	D 68
Current environmental impact rating:	A 93

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 108	-47 kg (3.6%)
U Solar photovoltaic panels	+ 3.6	-£ 311	-147 kg (11.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£108	0.20 kg/m²	C 69 A 94
Solar photovoltaic panels	£311	0.63 kg/m²	C 73 A 94
Total Savings	£419	0.83 kg/m²	

Potential energy efficiency rating:	C 73
Potential environmental impact rating:	A 94

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
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	£2481	£2374	£108
Space heating	£1842	£1866	-£24
Water heating	£542	£411	£131
Lighting	£97	£97	£0
Generated (PV)	-£0	-£311	£311
Total cost of fuels	£2481	£2063	£419
Total cost of uses	£2481	£2063	£418
Delivered energy	37 kWh/m²	31 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.1 tonnes	0.2 tonnes
CO2 emissions per m²	6 kg/m²	5 kg/m²	1 kg/m²
Primary energy	58 kWh/m²	49 kWh/m²	9 kWh/m²

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

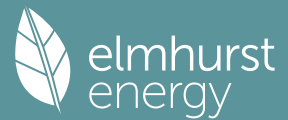
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	670.3694 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)

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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	Air changes per hour	0.0597 (8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				5.0000	(17)
Infiltration rate				0.3097	(18)
Number of sides sheltered				0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =			0.3097	(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)
Effective ac	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639	(22b)
	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.5918	5.3801		(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	157.1795		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		107.3765 (35)

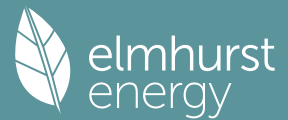
List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	40.2200	1.0000	40.2200
E3 Sill	40.2200	0.1000	4.0220
E4 Jamb	65.3800	0.1000	6.5380
E5 Ground floor (normal)	46.4800	0.3200	14.8736
E6 Intermediate floor within a dwelling	46.5100	0.1400	6.5114
E16 Corner (normal)	22.9200	0.1800	4.1256
R11 Upstands or kerbs of rooflights	12.3600	0.2400	2.9664
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			79.2570 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 236.4365 (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	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2179	122.8687	124.0354	125.2552	(38)
Heat transfer coeff	364.2904	363.6209	362.9646	359.8819	359.3051	356.6203	356.6203	356.1230	357.6544	359.3051	360.4719	361.6917	(39)
Average = Sum(39)m / 12 =												359.8791	
HLP	1.5475	1.5446	1.5418	1.5287	1.5263	1.5149	1.5149	1.5128	1.5193	1.5263	1.5313	1.5364	(40)
HLP (average)												1.5287	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (42)
Hot water usage for mixer showers												
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)	
Hot water usage for baths												
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)	
Hot water usage for other uses												
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)	
Average daily hot water use (litres/day)												141.2695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2849 (44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Energy content (annual)	Total = Sum(45)m =											2346.4575
Distribution loss (46)m = 0.15 x (45)m												
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)	
Water storage loss (or HIU loss):												
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												0.8434 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.5369 (55)
Total storage loss												

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If cylinder contains dedicated solar storage	47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446 (56)
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	47.6446 (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	31.1612 (59)
Total heat required for water heating calculated for each month	322.2028	285.3492	301.9551	259.3189	243.9321	215.9708	212.7441	222.2891	231.1958	269.3503	287.0674	0.0000 (61)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	318.8130 (62)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000 (63a)
Aperture area of solar collector												0.0000 (63b)
Zero-loss collector efficiency												3.0000 (H1)
Collector linear heat loss coefficient												0.8000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector loop efficiency												0.0000 (H4)
Incidence angle modifier												0.9000 (H5)
Overshading factor												1.0000 (H6)
Overall heat loss coefficient of system												0.8000 (H8)
Heat loss coefficient of collector loop												6.5000 (H10)
Dedicated solar storage volume												3.9667 (H11)
Effective solar volume												75.0000 (H12)
Reference volume												75.0000 (H14)
Storage tank correction coefficient												225.0000 (H15)
Heat delivered to hot water												1.3161 (H16)
Heat delivered to space heating												645.1557 (H24)
Solar input												0.0000 (H29)
Solar input	-0.0000	-16.1748	-59.5209	-82.8706	-109.6540	-101.1019	-100.6010	-87.1310	-59.2426	-28.8589	-0.0000	645.1557
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000 (63c)
Output from w/h	322.2028	269.1744	242.4342	176.4483	134.2781	114.8689	112.1431	135.1580	171.9532	240.4915	287.0674	0.0000 (63d)
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	143.9741	128.1550	136.3677	117.6474	109.9368	97.9963	97.7963	101.4050	106.4265	125.5266	131.1032	142.8470 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.3202	42.9175	34.9029	26.4237	19.7521	16.6755	18.0185	23.4211	31.4358	39.9149	46.5866	49.6631	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5895	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	193.5136	190.7068	183.2899	163.3992	147.7645	136.1060	131.4467	136.2971	147.8145	168.7186	182.0877	191.9987	(72)
Total internal gains	964.4679	962.5089	931.3265	869.4251	804.7912	747.2741	717.3810	721.3836	756.6665	822.5813	884.9497	937.7192	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.1100	10.6334		0.6300		0.7000		0.7700		23.1054 (74)
East				21.7500	19.6403		0.6300		0.7000		0.7700		130.5505 (76)
South				19.3500	46.7521		0.6300		0.7000		0.7700		276.4736 (78)
West				27.3600	19.6403		0.6300		0.7000		0.7700		164.2235 (80)
East				1.6900	26.6072		0.6300		0.7000		1.0000		17.8471 (82)
West				1.6900	26.6072		0.6300		0.7000		1.0000		17.8471 (82)
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)
Total gains	1594.5150	2108.2605	2657.4688	3217.9150	3586.2455	3564.2057	3410.8655	3090.5067	2701.8843	2134.9160	1653.6423	1467.3733	(84)

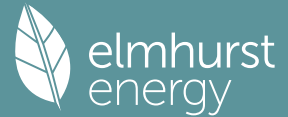
7. Mean internal temperature (heating season)

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	19.2745	19.3100	19.3449	19.5106	19.5420	19.6891	19.6891	19.7166	19.6322	19.5420	19.4787	19.4130	
alpha	2.2850	2.2873	2.2897	2.3007	2.3028	2.3126	2.3126	2.3144	2.3088	2.3028	2.2986	2.2942	
util living area	0.9650	0.9359	0.8842	0.7939	0.6722	0.5339	0.4154	0.4648	0.6656	0.8598	0.9462	0.9706	(86)
MIT	18.3686	18.7318	19.2630	19.8728	20.3528	20.6575	20.7836	20.7561	20.4969	19.8161	18.9644	18.3019	(87)
Th 2	19.6521	19.6542	19.6563	19.6660	19.6678	19.6764	19.6764	19.6779	19.6731	19.6678	19.6641	19.6603	(88)
util rest of house	0.9587	0.9248	0.8644	0.7587	0.6157	0.4496	0.3054	0.3520	0.5866	0.8269	0.9350	0.9653	(89)
MIT 2	16.6154	17.0731	17.7350	18.4799	19.0331	19.3590	19.4677	19.4522	19.2133	18.4387	17.3804	16.5359	(90)
Living area fraction									fLA = Living area / (4) =			0.2269	(91)
MIT	17.0132	17.4495	18.0818	18.7959	19.3326	19.6536	19.7663	19.7481	19.5045	18.7512	17.7399	16.9367	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0132	17.4495	18.0818	18.7959	19.3326	19.6536	19.7663	19.7481	19.5045	18.7512	17.7399	16.9367	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1500.2158	1897.6995	2218.2656	2354.0165	2150.4591	1596.6954	1069.0277	1107.9406	1553.9221	1703.7376	1508.5751	1393.1998	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)

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Heat loss rate W	4631.3122	4563.2580	4203.7760	3561.3728	2742.4243	1802.2265	1129.1661	1192.3244	1932.9567	2928.7825	3835.3737	4606.7455	(97)
Space heating kWh	2329.5357	1791.2553	1477.2197	869.2966	440.4222	0.0000	0.0000	0.0000	0.0000	911.4334	1675.2950	2390.8780	(98a)
Space heating requirement - total per year (kWh/year)												11885.3359	
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	2329.5357	1791.2553	1477.2197	869.2966	440.4222	0.0000	0.0000	0.0000	0.0000	911.4334	1675.2950	2390.8780	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11885.3359	
Space heating per m2												50.4878	(99)
												(98c) / (4) =	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													170.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2329.5357	1791.2553	1477.2197	869.2966	440.4222	0.0000	0.0000	0.0000	0.0000	911.4334	1675.2950	2390.8780	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	1370.3151	1053.6796	868.9528	511.3509	259.0719	0.0000	0.0000	0.0000	0.0000	536.1373	985.4676	1406.3988	(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	322.2028	269.1744	242.4342	176.4483	134.2781	114.8689	112.1431	135.1580	171.9532	240.4915	287.0674	318.8130	(64)	
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	189.5311	158.3379	142.6083	103.7931	78.9871	67.5699	65.9665	79.5047	101.1490	141.4656	168.8632	187.5370	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)	
Lighting	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-42.9746	-66.9543	-104.6751	-124.5263	-134.2847	-111.4920	-109.8798	-101.8736	-87.8827	-78.2702	-49.0996	-36.4641	(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												6991.3741	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												170.0000		
Water heating fuel used												1485.3135	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												341.3397	(232)	

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

PV generation													-1048.3768	(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													7849.6504	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6991.3741	16.4900	1152.8776	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1485.3135	16.4900	244.9282	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	341.3397	16.4900	56.2869	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1048.3768	16.4900	-172.8773	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-172.8773	(252)
Total energy cost			1294.4074	(255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.6618 (257)
SAP value		73.0621
SAP rating (Section 12)		73 (258)
SAP band		C

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	6991.3741	0.1549	1083.1838 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1485.3135	0.1450	215.2970 (264)
Space and water heating			1298.4808 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	341.3397	0.1443	49.2659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1048.3768	0.1345	-140.9753
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-140.9753 (269)
Total CO ₂ , kg/year			1217.8684 (272)
CO ₂ emissions per m ²			5.1700 (273)
EI value			94.1802
EI rating			94 (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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

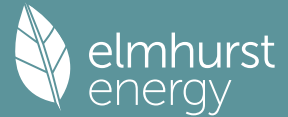
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3097 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3097 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.3406	0.3329	0.3329	0.2942	0.2942	0.2555	0.2555	0.2632	0.2632	0.2864	0.2942	0.3097 (22b)
Effective ac	0.5580	0.5554	0.5554	0.5433	0.5433	0.5326	0.5326	0.5346	0.5346	0.5410	0.5433	0.5479 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.5918	5.3801		(27a)
GF			122.0000	0.1300	15.8600	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1800	11.4354	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1800	6.3234	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1800	11.2338	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1800	3.2166	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)

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Total net area of external elements Aum(A, m2)	536.2500			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	157.1795		(33)
Main dwelling				
GF	169.3300	9.0000	1523.9700	(32c)
1ST MASTER	37.7600	9.0000	339.8400	(32c)
1ST BEDROOM	107.2800	9.0000	965.5200	(32c)
1ST LAND	148.6600	9.0000	1337.9400	(32c)
FF	113.4100	18.0000	2041.3800	(32d)
GF	113.4100	9.0000	1020.6900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.3765 (35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	40.2200	1.0000	40.2200	
E3 Sill	40.2200	0.1000	4.0220	
E4 Jamb	65.3800	0.1000	6.5380	
E5 Ground floor (normal)	46.4800	0.3200	14.8736	
E6 Intermediate floor within a dwelling	46.5100	0.1400	6.5114	
E16 Corner (normal)	22.9200	0.1800	4.1256	
R11 Upstands or kerbs of rooflights	12.3600	0.2400	2.9664	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			79.2570	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	236.4365 (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	123.4454	122.8687	122.8687	120.1838	120.1838	117.8303	117.8303	118.2745	118.2745	119.6866	120.1838	121.2179	(38)
Average = Sum(39)m / 12 =	359.8819	359.3051	359.3051	356.6203	356.6203	354.2668	354.2668	354.7110	354.7110	356.1230	356.6203	357.6544	(39)
												356.6738	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5287	1.5263	1.5263	1.5149	1.5149	1.5049	1.5049	1.5068	1.5068	1.5128	1.5149	1.5193	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

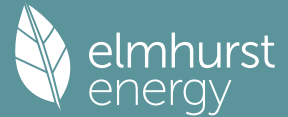
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480	(42)
Hot water usage for mixer showers														
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	75.0356	(42a)	
Hot water usage for baths														
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	32.4052	(42b)	
Hot water usage for other uses														
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	45.8442	(42c)	
Average daily hot water use (litres/day)													141.2695	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2849	(44)	
Energy content (annual)	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2346.4575		
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	36.0011	(46)	
Water storage loss (or HIU loss):														
Store volume													200.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152	(51)
Volume factor from Table 2a													0.8434	(52)
Temperature factor from Table 2b													0.6000	(53)
Enter (49) or (54) in (55)													1.5369	(55)
Total storage loss														
47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	(56)	
If cylinder contains dedicated solar storage														
47.6446	43.0338	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	46.1077	47.6446	46.1077	47.6446	47.6446	(57)	
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612	(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														
322.2028	285.3492	301.9551	259.3189	243.9321	215.9708	212.7441	222.2891	231.1958	269.3503	287.0674	318.8130	318.8130	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													711.5692	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													711.5692	
Solar input	-0.0000	-19.3983	-63.4555	-89.5981	-113.9754	-111.0257	-109.3344	-96.3757	-67.6492	-37.1576	-3.5994	-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														
322.2028	265.9509	238.4995	169.7208	129.9568	104.9451	103.4097	125.9134	163.5466	232.1928	283.4680	318.8130	318.8130	(64)	
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month														
143.9741	128.1550	136.3677	117.6474	109.9368	97.9963	97.7963	101.4050	106.4265	125.5266	131.1032	142.8470	142.8470	(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	
182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	48.3202	42.9175	34.9029	26.4237	19.7521	16.6755	18.0185	23.4211	31.4358	39.9149	46.5866	49.6631 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	602.3392	608.5895	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624 (68)
Pumps, fans	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Total internal gains	193.5136	190.7068	183.2899	163.3992	147.7645	136.1060	131.4467	136.2971	147.8145	168.7186	182.0877	191.9987 (72)
	964.4679	962.5089	931.3265	869.4251	804.7912	747.2741	717.3810	721.3836	756.6665	822.5813	884.9497	937.7192 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.1100	12.0539		0.6300		0.7000		0.7700		26.1920 (74)
East				21.7500	22.4175		0.6300		0.7000		0.7700		149.0108 (76)
South				19.3500	51.7504		0.6300		0.7000		0.7700		306.0318 (78)
West				27.3600	22.4175		0.6300		0.7000		0.7700		187.4453 (80)
East				1.6900	30.5425		0.6300		0.7000		1.0000		20.4867 (82)
West				1.6900	30.5425		0.6300		0.7000		1.0000		20.4867 (82)
Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271		590.7272 (83)
Total gains	1674.1212	2165.7019	2713.4131	3340.1371	3659.6161	3779.2931	3585.1347	3256.0118	2852.2104	2262.8932	1772.0768		1528.4464 (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	19.5106	19.5420	19.5420	19.6891	19.6891	19.8199	19.8199	19.7951	19.7951	19.7166	19.6891	19.6322
alpha	2.3007	2.3028	2.3028	2.3126	2.3126	2.3213	2.3213	2.3197	2.3197	2.3144	2.3126	2.3088
util living area	0.9604	0.9307	0.8737	0.7687	0.6387	0.4680	0.3342	0.3637	0.6040	0.8307	0.9359	0.9673 (86)
MIT	18.4744	18.8227	19.3768	19.9973	20.4435	20.7290	20.8257	20.8169	20.6034	19.9742	19.0970	18.3970 (87)
Th 2	19.6660	19.6678	19.6678	19.6764	19.6764	19.6838	19.6838	19.6824	19.6824	19.6779	19.6764	19.6731 (88)
util rest of house	0.9533	0.9188	0.8520	0.7298	0.5772	0.3785	0.2201	0.2412	0.5145	0.7912	0.9226	0.9614 (89)
MIT 2	16.7575	17.1956	17.8830	18.6333	19.1380	19.4277	19.5009	19.4963	19.3250	18.6333	17.5540	16.6641 (90)
Living area fraction									fLA = Living area / (4) =			0.2269 (91)
MIT	17.1471	17.5648	18.2220	18.9428	19.4343	19.7230	19.8015	19.7960	19.6151	18.9376	17.9042	17.0574 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1471	17.5648	18.2220	18.9428	19.4343	19.7230	19.8015	19.7960	19.6151	18.9376	17.9042	17.0574 (93)

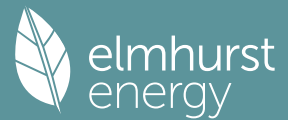
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.8934	0.8223	0.7046	0.5646	0.3814	0.2308	0.2524	0.5094	0.7636	0.8981	0.9445 (94)
Useful gains	1564.0733	1934.8779	2231.2420	2353.5322	2066.3790	1441.3520	827.5755	821.6931	1452.9319	1727.9806	1591.5878	1443.5799 (95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)
Heat loss rate W	4551.4646	4478.6801	4068.0360	3403.1682	2544.2197	1566.9200	850.7894	849.8707	1707.9746	2755.5219	3745.9934	4526.9607 (97)
Space heating kWh	2222.6191	1709.4351	1366.5747	755.7379	355.5135	0.0000	0.0000	0.0000	0.0000	764.4907	1551.1720	2294.0353 (98a)
Space heating requirement - total per year (kWh/year)												11019.5784
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	2222.6191	1709.4351	1366.5747	755.7379	355.5135	0.0000	0.0000	0.0000	0.0000	764.4907	1551.1720	2294.0353 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11019.5784
Space heating per m2										(98c) / (4) =		46.8102 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2222.6191	1709.4351	1366.5747	755.7379	355.5135	0.0000	0.0000	0.0000	0.0000	764.4907	1551.1720	2294.0353 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	1307.4230	1005.5501	803.8675	444.5517	209.1256	0.0000	0.0000	0.0000	0.0000	449.7004	912.4541	1349.4325 (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	322.2028	265.9509	238.4995	169.7208	129.9568	104.9451	103.4097	125.9134	163.5466	232.1928	283.4680	318.8130 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	189.5311	156.4417	140.2938	99.8358	76.4452	61.7324	60.8292	74.0667	96.2039	136.5840	166.7459	187.5370 (219)

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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	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	(231)
Lighting	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	43.4699	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-47.9411	-69.8407	-106.9492	-127.7052	-134.0451	-116.1562	-113.7819	-106.0878	-92.4279	-83.5615	-55.7059	-40.3640	-40.3640	(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	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	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													6482.1050	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.0000	
Water heating fuel used													1446.2467	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													80.0000	(231)
Electricity for lighting (calculated in Appendix L)													341.3397	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1094.5665	(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													7255.1248	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6482.1050	28.4300	1842.8624	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1446.2467	28.4300	411.1679	(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)
Pump for solar water heating	80.0000	28.4300	22.7440	(249)
Energy for lighting	341.3397	28.4300	97.0429	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1094.5665	28.4300	-311.1853	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-311.1853	(252)
Total energy cost			2062.6320	(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	6482.1050	0.1554	1007.0625	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1446.2467	0.1454	210.2713	(264)
Space and water heating			1217.3338	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	341.3397	0.1443	49.2659	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1094.5665	0.1347	-147.3898	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-147.3898	(269)
Total CO2, kg/year			1130.3069	(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	6482.1050	1.5752	10210.3738	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1446.2467	1.5378	2224.0470	(278)
Space and water heating			12434.4207	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	341.3397	1.5338	523.5582	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1094.5665	1.4977	-1639.3221	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1639.3221	(283)
Total Primary energy kWh/year			11439.6809	(286)

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Plot Reference	BASE/BELEAN/BEGREEN			Issued on Date	27/01/2026
Assessment Reference	Baseline annex dwelling	Plot Type Ref	Flint House		
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD			SAP Version	10.2
SAP Rating	71 C	DER	8.87	TER	12.38
Environmental	94 A	% DER < TER			28.35
CO ₂ Emissions (t/year)	0.4	DFEE	61.80	TFEE	49.73
Compliance Check	See BREL	% DFEE < TFEE			-24.26
% DPER < TPER	-39.77	DPER	92.42	TPER	66.12
Assessor Details	Mr. Neil Bradford			Assessor ID	T704-0001
Client	Flint House, Joe Reader				

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	48.9300 (1b)	3.1400 (2b)	153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402 (4)
Dwelling volume			153.6402 (5)

2. Ventilation rate

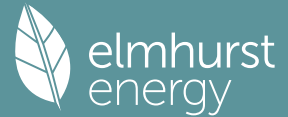
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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)
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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.3000 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10652.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	1.0000	5.7700	
E3 Sill				5.7700	0.1000	0.5770	
E4 Jamb				9.6400	0.1000	0.9640	
E5 Ground floor (normal)				22.8400	0.3200	7.3088	
E16 Corner (normal)				12.5600	0.1800	2.2608	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8806 (36)
Point Thermal bridges						(36a) =	0.0000

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Total fabric heat loss (33) + (36) + (36a) = 52.0369 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Heat transfer coeff	82.4839	82.2860	82.0920	81.1809	81.0105	80.2169	80.2169	80.0700	80.5226	81.0105	81.3553	81.7158 (39)
Average = Sum(39)m / 12 =												81.1801

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6858	1.6817	1.6777	1.6591	1.6556	1.6394	1.6394	1.6364	1.6457	1.6556	1.6627	Dec 1.6701 (40)
HLP (average)												1.6591
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6586 (42)

Hot water usage for mixer showers 66.7705 65.7671 64.3049 61.5072 59.4426 57.1402 55.8315 57.2826 58.8734 61.3454 64.2032 66.5147 (42a)

Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)

Hot water usage for other uses 31.6162 30.4665 29.3168 28.1672 27.0175 25.8678 25.8678 27.0175 28.1672 29.3168 30.4665 31.6162 (42c)

Average daily hot water use (litres/day) 90.3022 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Energy content (annual)												Total = Sum(45)m = 1500.0391
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Total per year (kWh/year)												2054.8515 (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	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973 (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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains	391.5738	399.0708	383.9650	370.7439	353.4816	330.0032	318.2156	319.2072	328.3377	350.8530	370.7441	384.2297 (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
South	6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)
West	3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424
Total gains	509.9461	599.2805	653.5385	696.4922	710.1104	680.2455
						339.2691
						657.4847
						636.1423
						617.5418
						571.0077
						512.2820
						485.6825 (84)

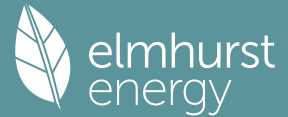
7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.8746	35.9609	36.0459	36.4504	36.5271	36.8885	36.8885	36.9562	36.7484	36.5271	36.3723	36.2118
alpha	3.3916	3.3974	3.4031	3.4300	3.4351	3.4592	3.4592	3.4637	3.4499	3.4351	3.4248	3.4141

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util living area	0.9781	0.9618	0.9369	0.8856	0.7969	0.6569	0.5060	0.5388	0.7327	0.8969	0.9625	0.9812 (86)
MIT	19.4588	19.6732	19.9540	20.3040	20.5991	20.8002	20.8772	20.8685	20.7392	20.3621	19.8530	19.4262 (87)
Th 2	19.5511	19.5540	19.5568	19.5703	19.5728	19.5846	19.5846	19.5867	19.5800	19.5728	19.5677	19.5624 (88)
util rest of house												
MIT 2	0.9717	0.9510	0.9183	0.8503	0.7313	0.5453	0.3570	0.3908	0.6321	0.8576	0.9499	0.9757 (89)
Living area fraction	17.8197	18.0898	18.4401	18.8719	19.2054	19.4085	19.4603	19.4586	19.3568	18.9526	18.3299	17.7867 (90)
MIT	18.9058	19.1389	19.4432	19.8208	20.1288	20.3306	20.3991	20.3928	20.2728	19.8865	19.3391	18.8730 (91)
Temperature adjustment												0.0000
adjusted MIT	18.9058	19.1389	19.4432	19.8208	20.1288	20.3306	20.3991	20.3928	20.2728	19.8865	19.3391	18.8730 (93)

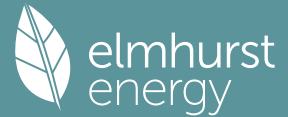
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9680	0.9472	0.9165	0.8573	0.7591	0.6074	0.4455	0.4784	0.6850	0.8675	0.9474	0.9723	(94)
Useful gains	493.6447	567.6086	598.9976	597.0983	539.0587	413.1679	292.9340	304.3146	422.9957	495.3774	485.3175	472.2242	(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	1204.7399	1171.6655	1062.5348	886.5607	682.8244	459.6928	304.7554	319.6993	497.0486	752.3027	995.7133	1199.0165	(97)
Space heating kWh	529.0548	405.9262	344.8717	208.4129	106.9617	0.0000	0.0000	0.0000	0.0000	191.1524	367.4850	540.7334	(98a)
Space heating requirement - total per year (kWh/year)												2694.5982	
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	529.0548	405.9262	344.8717	208.4129	106.9617	0.0000	0.0000	0.0000	0.0000	191.1524	367.4850	540.7334	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2694.5982	
Space heating per m2											(98c) / (4) =	55.0705	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	529.0548	405.9262	344.8717	208.4129	106.9617	0.0000	0.0000	0.0000	0.0000	191.1524	367.4850	540.7334	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	311.2087	238.7801	202.8657	122.5958	62.9187	0.0000	0.0000	0.0000	0.0000	112.4426	216.1676	318.0785	(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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532	(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	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098	(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												1585.0578	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1208.7362	(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)												122.5729	(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												2916.3669	(238)

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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	1585.0578	0.1549	245.5871 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1208.7362	0.1412	170.6246 (264)
Space and water heating			416.2117 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Total CO ₂ , kg/year			433.9027 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.8700 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1585.0578	1.5736	2494.2589 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1208.7362	1.5220	1839.6663 (278)
Space and water heating			4333.9253 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	122.5729	1.5338	188.0065 (282)
Total Primary energy kWh/year			4521.9317 (286)
Dwelling Primary energy Rate (DPER)			92.4200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	48.9300	3.1400	153.6402
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402
Dwelling volume			153.6402

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	2 * 10 = 20.0000 (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) = 20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)

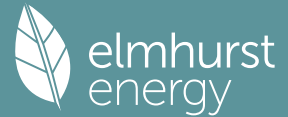
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Adj infilt rate	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854

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							
TER Opening Type			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609		(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502		(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544		(30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.1563		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0500	0.2885	
E3 Sill				5.7700	0.0500	0.2885	
E4 Jamb				9.6400	0.0500	0.4820	
E5 Ground floor (normal)				22.8400	0.1600	3.6544	

7. Mean internal temperature (heating season)	
Temperature during heating periods in the living area from Table 9, T_{hi} (C)	21.0000 (85)
Utilisation factor for gains for living area, $u_{li,m}$ (see Table 9a)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.4163	41.5314	41.6448	42.1857	42.2885	42.7735	42.7735	42.8646	42.5854	42.2885	42.0811	41.8664
alpha	3.7611	3.7688	3.7763	3.8124	3.8192	3.8516	3.8516	3.8576	3.8390	3.8192	3.8054	3.7911
util living area	0.9777	0.9590	0.9293	0.8673	0.7632	0.6029	0.4514	0.4831	0.6852	0.8818	0.9600	0.9812 (86)
MIT	19.3810	19.6609	20.0042	20.4136	20.7295	20.9210	20.9798	20.9735	20.8658	20.4601	19.8561	19.3386 (87)
Th 2	19.7175	19.7206	19.7236	19.7377	19.7403	19.7527	19.7527	19.7550	19.7480	19.7403	19.7350	19.7294 (88)
util rest of house	0.9715	0.9479	0.9101	0.8310	0.6991	0.5040	0.3297	0.3607	0.5916	0.8416	0.9473	0.9759 (89)
MIT 2	17.9008	18.2518	18.6769	19.1737	19.5216	19.7085	19.7464	19.7460	19.6632	19.2419	18.5114	17.8554 (90)
Living area fraction	18.8816	19.1854	19.5563	19.9953	20.3219	20.5119	20.5636	20.5593	20.4600	20.0490	19.4023	18.8381 (92)
MIT	18.8816	19.1854	19.5563	19.9953	20.3219	20.5119	20.5636	20.5593	20.4600	20.0490	19.4023	18.8381 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8816	19.1854	19.5563	19.9953	20.3219	20.5119	20.5636	20.5593	20.4600	20.0490	19.4023	18.8381 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9663	0.9423	0.9071	0.8392	0.7305	0.5660	0.4100	0.4412	0.6473	0.8527	0.9431	0.9711 (94)
Useful gains	482.1797	554.3882	582.9102	575.3343	510.7176	383.6214	268.5509	279.5607	398.1194	477.5371	472.8235	461.0065 (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	1041.8115	1017.8257	927.7212	778.2680	603.3065	408.9855	274.2045	287.1312	441.9321	661.1826	865.0817	1034.6091 (97)
Space heating kWh	416.3661	311.4300	256.5393	146.1123	68.8862	0.0000	0.0000	0.0000	0.0000	136.6323	282.4259	426.7603 (98a)
Space heating requirement - total per year (kWh/year)												2045.1523
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	416.3661	311.4300	256.5393	146.1123	68.8862	0.0000	0.0000	0.0000	0.0000	136.6323	282.4259	426.7603 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2045.1523
Space heating per m2										(98c) / (4) =		41.7975 (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	416.3661	311.4300	256.5393	146.1123	68.8862	0.0000	0.0000	0.0000	0.0000	136.6323	282.4259	426.7603 (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)	451.1009	337.4106	277.9408	158.3015	74.6329	0.0000	0.0000	0.0000	0.0000	148.0306	305.9869	462.3622 (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	164.8772	145.7900	155.2055	137.6565	134.1581	121.7052	120.8919	125.3555	126.3202	139.8401	147.3843	163.2712 (64)
Efficiency of water heater (217)m	86.0472	85.7174	85.1788	84.1937	82.6416	79.8000	79.8000	79.8000	79.8000	84.0078	85.4937	79.8000 (216)
Fuel for water heating, kWh/month	191.6126	170.0821	182.2114	163.4998	162.3372	152.5128	151.4936	157.0871	158.2960	166.4610	172.3921	189.6021 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-38.9228	-51.7219	-70.1836	-74.4450	-76.8261	-70.6354	-69.8455	-67.6130	-63.1812	-57.0318	-41.6971	-34.0444 (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)	-32.7203	-67.2292	-130.7421	-192.3228	-250.4835	-250.2149	-247.1665	-210.8858	-156.8367	-94.5864	-43.1650	-25.9868 (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												2215.7663 (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												2017.5877 (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)												122.5729 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2418.4878 (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												2023.4391 (238)

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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	2215.7663	0.2100	465.3109 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2017.5877	0.2100	423.6934 (264)
Space and water heating			889.0043 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-716.1479	0.1358	-97.2564
PV Unit electricity exported	-1702.3399	0.1265	-215.3981
Total			-312.6545 (269)
Total CO2, kg/year			605.9702 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3800 (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	2215.7663	1.1300	2503.8160 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2017.5877	1.1300	2279.8741 (278)
Space and water heating			4783.6900 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	122.5729	1.5338	188.0065 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-716.1479	1.5020	-1075.6383
PV Unit electricity exported	-1702.3399	0.4645	-790.7087
Total			-1866.3470 (283)
Total Primary energy kWh/year			3235.4503 (286)
Target Primary Energy Rate (TPER)			66.1200 (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	48.9300	3.1400	153.6402
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402
Dwelling volume			153.6402

2. Ventilation rate

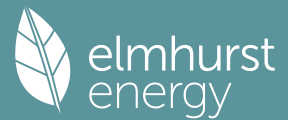
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (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	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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Main dwelling		m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K					
Windows				10.2100	1.1450	11.6908			(27)				
GF				48.9300	0.1300	6.3609	110.0000	5382.3000	(28a)				
External Wall	71.6000	10.2100		61.3900	0.1800	11.0502	70.0000	4297.3000	(29a)				
SLOPING ROOF	55.0400			55.0400	0.1100	6.0544	9.0000	495.3600	(30)				
Total net area of external elements Aum(A, m2)				175.5700					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563				(33)				
Main dwelling													
GF				53.0800			9.0000	477.7200	(32e)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	10652.6800			(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								217.7127	(35)				
List of Thermal Bridges													
K1 Element					Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)					5.7700	1.0000	5.7700						
E3 Sill					5.7700	0.1000	0.5770						
E4 Jamb					9.6400	0.1000	0.9640						
E5 Ground floor (normal)					22.8400	0.3200	7.3088						
E16 Corner (normal)					12.5600	0.1800	2.2608						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.8806	(36)				
Point Thermal bridges								0.0000					
Total fabric heat loss						(33) + (36) + (36a) =		52.0369	(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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Average = Sum(39)m / 12 =	82.4839	82.2860	82.0920	81.1809	81.0105	80.2169	80.2169	80.0700	80.5226	81.0105	81.3553	81.7158	(39)
												81.1801	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.6858	1.6817	1.6777	1.6591	1.6556	1.6394	1.6394	1.6364	1.6457	1.6556	1.6627	1.6701	(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													1.6586	(42)
Hot water usage for mixer showers														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths														
22.4976	22.1635	21.6930	20.8255	20.1759	19.4555	19.0665	19.5337	20.0424	20.8132	21.6986	22.4216	22.4216	(42b)	
Hot water usage for other uses														
31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	31.6162	(42c)	
Average daily hot water use (litres/day)													49.6009	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378	54.0378	(44)	
Energy conte	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101	(45)	
Energy content (annual)													823.7641	
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):														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186	71.9186	(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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186	(64)	
Total per year (kWh/year)													700.1995	(64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													473.9595	(64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964	(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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815	138.0815	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	(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)														
-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)	
Water heating gains (Table 5)														
38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672	38.1672	(72)	
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231	(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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South	6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)
West	3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)

Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356	398.6759 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.8746	35.9609	36.0459	36.4504	36.5271	36.8885	36.8885	36.9562	36.7484	36.5271	36.3723	36.2118
alpha	3.3916	3.3974	3.4031	3.4300	3.4351	3.4592	3.4592	3.4637	3.4499	3.4351	3.4248	3.4141
util living area	0.9874	0.9753	0.9560	0.9137	0.8367	0.6994	0.5479	0.5842	0.7764	0.9276	0.9772	0.9895 (86)
MIT	18.8861	19.1830	19.5749	20.0734	20.5048	20.8193	20.9425	20.9269	20.7218	20.1467	19.4278	18.8407 (87)
Th 2	19.5511	19.5540	19.5568	19.5703	19.5728	19.5846	19.5846	19.5867	19.5800	19.5728	19.5677	19.5624 (88)
util rest of house	0.9835	0.9678	0.9421	0.8846	0.7774	0.5882	0.3907	0.4291	0.6804	0.8970	0.9690	0.9863 (89)
MIT 2	17.6966	17.9907	18.3754	18.8607	19.2504	19.5033	19.5708	19.5672	19.4374	18.9420	18.2452	17.6596 (90)
Living area fraction									fLA = Living area / (4) =			0.6626 (91)
MIT	18.4847	18.7807	19.1701	19.6642	20.0815	20.3752	20.4796	20.4681	20.2884	19.7402	19.0287	18.4422 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4847	18.7807	19.1701	19.6642	20.0815	20.3752	20.4796	20.4681	20.2884	19.7402	19.0287	18.4422 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9796	0.9627	0.9375	0.8869	0.8009	0.6542	0.4936	0.5299	0.7326	0.9013	0.9649	0.9829 (94)
Useful gains	413.6708	493.3567	533.2105	546.7698	506.9470	404.0144	294.6508	304.2398	405.8241	443.9413	414.1816	391.8546 (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	1170.0105	1142.1886	1040.1175	873.8498	678.9914	463.2719	311.2131	325.7359	498.3034	740.4495	970.4663	1163.8127 (97)
Space heating kWh	562.7167	436.0150	377.1388	235.4976	128.0010	0.0000	0.0000	0.0000	0.0000	220.6021	400.5250	574.3369 (98a)
Space heating requirement - total per year (kWh/year)												2934.8331
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	562.7167	436.0150	377.1388	235.4976	128.0010	0.0000	0.0000	0.0000	0.0000	220.6021	400.5250	574.3369 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2934.8331
Space heating per m2												(98c) / (4) = 59.9802 (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	754.0390	593.6051	608.5317	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7436	0.8218	0.7997	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	560.7346	487.8189	486.6341	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.8664	673.1160	647.9768	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.2949	137.8610	120.0389	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.3237	34.4653	30.0097	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												88.7987 (107)
Energy for space heating												59.9802 (99)
Energy for space cooling												1.8148 (108)
Total												61.7950 (109)
Fabric Energy Efficiency (DFEE)												61.8 (109)

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

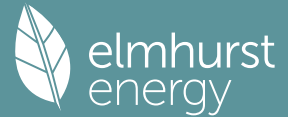
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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)

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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	2 * 10 =	20.0000 (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) =	20.0000	Air changes per hour	20.0000 / (5) =	0.1302 (8)
Pressure test			Yes		
Pressure Test Method			Blower Door		
Measured/design AP50					5.0000 (17)
Infiltration rate					0.3802 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3517 (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)
	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(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	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(25)

3. Heat losses and heat loss parameter

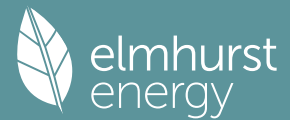
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opening Type			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609		(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502		(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544		(30)
Total net area of external elements Aum(A, m2)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.1563		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0500	0.2885	
E3 Sill				5.7700	0.0500	0.2885	
E4 Jamb				9.6400	0.0500	0.4820	
E5 Ground floor (normal)				22.8400	0.1600	3.6544	
E16 Corner (normal)				12.5600	0.0900	1.1304	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8438 (36)
Point Thermal Bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	41.0001 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Average = Sum(39)m / 12 =	71.4471	71.2492	71.0552	70.1441	69.9737	69.1801	69.1801	69.0332	69.4858	69.9737	70.3185	70.6790	(39)
												70.1433	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4602	1.4561	1.4522	1.4336	1.4301	1.4139	1.4139	1.4109	1.4201	1.4301	1.4371	1.4445	(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													1.6586 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	22.4976	22.1635	21.6930	20.8255	20.1759	19.4555	19.0665	19.5337	20.0424	20.8132	21.6986	22.4216	(42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)
Average daily hot water use (litres/day)													49.6009 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378	(44)
Energy content (annual)	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101	(45)
Distribution loss (46)m = 0.15 x (45)m													823.7641
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186	(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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186	(64)
12Total per year (kWh/year)													700.1995 (64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													473.9595 (64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672 (72)
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231 (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	
South					6.8900	46.7521	0.6300		0.7000			0.7700			98.4446 (78)
West					3.3200	19.6403	0.6300		0.7000			0.7700			19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379			101.4528 (83)	
Total gains	422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356			398.6759 (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	41.4163	41.5314	41.6448	42.1857	42.2885	42.7735	42.7735	42.8646	42.5854	42.2885	42.0811	41.8664
alpha	3.7611	3.7688	3.7763	3.8124	3.8192	3.8516	3.8516	3.8576	3.8390	3.8192	3.8054	3.7911
util living area	0.9869	0.9729	0.9495	0.8970	0.8033	0.6466	0.4905	0.5264	0.7326	0.9141	0.9750	0.9893 (86)
MIT	19.2177	19.5101	19.8729	20.3177	20.6715	20.8994	20.9732	20.9645	20.8296	20.3594	19.7114	19.1742 (87)
Th 2	19.7175	19.7206	19.7236	19.7377	19.7403	19.7527	19.7527	19.7550	19.7480	19.7403	19.7350	19.7294 (88)
util rest of house	0.9831	0.9651	0.9348	0.8661	0.7434	0.5456	0.3606	0.3960	0.6407	0.8816	0.9665	0.9862 (89)
MIT 2	18.1419	18.4310	18.7857	19.2157	19.5279	19.7076	19.7460	19.7453	19.6611	19.2663	18.6430	18.1075 (90)
Living area fraction	18.8547	19.1460	19.5060	19.9459	20.2856	20.4973	20.5591	20.5531	20.4353	19.9906	19.3509	18.8143 (92)
Temperature adjustment	18.8547	19.1460	19.5060	19.9459	20.2856	20.4973	20.5591	20.5531	20.4353	19.9906	19.3509	18.8143 (93)
adjusted MIT	18.8547	19.1460	19.5060	19.9459	20.2856	20.4973	20.5591	20.5531	20.4353	19.9906	19.3509	18.8143 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9797	0.9608	0.9318	0.8718	0.7713	0.6082	0.4462	0.4816	0.6941	0.8890	0.9633	0.9832 (94)
Useful gains	413.7055	492.3971	529.9481	537.5103	488.2246	375.6018	266.3424	276.5032	384.4780	437.9156	413.4802	391.9778 (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	1039.8928	1015.0172	924.1468	774.8030	600.7688	407.9736	273.8910	286.7030	440.2160	657.0928	861.4640	1032.9250 (97)
Space heating kWh	465.8834	351.2007	293.2838	170.8507	83.7329	0.0000	0.0000	0.0000	0.0000	163.0678	322.5483	476.8647 (98a)
Space heating requirement - total per year (kWh/year)												2327.4323
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	465.8834	351.2007	293.2838	170.8507	83.7329	0.0000	0.0000	0.0000	0.0000	163.0678	322.5483	476.8647 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2327.4323
Space heating per m2										(98c) / (4) =		47.5666 (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	650.2930	511.9328	524.6520	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8199	0.8865	0.8686	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	533.1525	453.8165	455.7019	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.8664	673.1160	647.9768	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	117.1540	163.1588	143.0525	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.2885	40.7897	35.7631	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												105.8413 (107)
Energy for space heating												47.5666 (99)
Energy for space cooling												2.1631 (108)
Total												49.7297 (109)
Fabric Energy Efficiency (TFEE)												49.7 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (25)

3. Heat losses and heat loss parameter

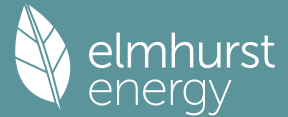
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.3000 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10652.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	1.0000	5.7700	
E3 Sill				5.7700	0.1000	0.5770	
E4 Jamb				9.6400	0.1000	0.9640	
E5 Ground floor (normal)				22.8400	0.3200	7.3088	
E16 Corner (normal)				12.5600	0.1800	2.2608	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8806 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	52.0369 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Average = Sum(39)m / 12 =	82.4839	82.2860	82.0920	81.1809	81.0105	80.2169	80.2169	80.0700	80.5226	81.0105	81.3553	81.7158 (39)
												81.1801
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6858	1.6817	1.6777	1.6591	1.6556	1.6394	1.6394	1.6364	1.6457	1.6556	1.6627	1.6701 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6586 (42)
Hot water usage for mixer showers												
	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147 (42a)
Hot water usage for baths												

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Hot water usage for other uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Average daily hot water use (litres/day)	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c) 90.3022 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Distribution loss (46)m = 0.15 x (45)m	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Water storage loss (or HIU loss):	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
								Total per year (kWh/year) = Sum(64)m =				2054.8515 (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	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973 (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	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3515	15.4114	12.5334	9.4886	7.0928	5.9881	6.4703	8.4104	11.2884	14.3332	16.7290	17.8337 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains	438.8839	437.3476	425.3348	402.6716	380.4502	348.7314	336.7232	338.9166	350.3491	382.3065	407.1568	428.8828 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c		Access factor Table 6d		Gains W
South				6.8900	46.7521	0.6300		0.7000		0.7700		98.4446 (78)
West				3.3200	19.6403	0.6300		0.7000		0.7700		19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	557.2562	637.5573	694.9084	728.4199	737.0791	698.9738	675.9924	655.8517	639.5532	602.4612	548.6947	530.3355 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.8746	35.9609	36.0459	36.4504	36.5271	36.8885	36.8885	36.9562	36.7484	36.5271	36.3723	36.2118
alpha	3.3916	3.3974	3.4031	3.4300	3.4351	3.4592	3.4592	3.4637	3.4499	3.4351	3.4248	3.4141
util living area	0.9718	0.9550	0.9265	0.8738	0.7829	0.6448	0.4942	0.5255	0.7179	0.8837	0.9549	0.9758 (86)
MIT	19.5295	19.7268	20.0061	20.3366	20.6177	20.8066	20.8796	20.8716	20.7504	20.3956	19.9041	19.4940 (87)
Th 2	19.5511	19.5540	19.5568	19.5703	19.5728	19.5846	19.5846	19.5867	19.5800	19.5728	19.5677	19.5624 (88)
util rest of house	0.9638	0.9424	0.9055	0.8361	0.7156	0.5334	0.3478	0.3799	0.6164	0.8411	0.9401	0.9688 (89)
MIT 2	17.9078	18.1554	18.5019	18.9077	19.2228	19.4126	19.4611	19.4598	19.3651	18.9889	18.3920	17.8715 (90)
Living area fraction	18.9823	19.1966	19.4986	19.8545	20.1470	20.3362	20.4010	20.3952	20.2829	19.9210	19.3939	18.9465 (91)
MIT	18.9823	19.1966	19.4986	19.8545	20.1470	20.3362	20.4010	20.3952	20.2829	19.9210	19.3939	18.9465 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9823	19.1966	19.4986	19.8545	20.1470	20.3362	20.4010	20.3952	20.2829	19.9210	19.3939	18.9465 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9599	0.9387	0.9045	0.8445	0.7449	0.5956	0.4348	0.4661	0.6703	0.8529	0.9379	0.9651 (94)
Ext temp.	534.8899	598.4730	628.5591	615.1761	549.0752	416.3311	293.9319	305.6923	428.6773	513.8487	514.6154	511.8229 (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)
	1211.0509	1176.4074	1067.0793	889.2958	684.2983	460.1416	304.9020	319.8995	497.8670	755.0955	1000.1765	1205.0244 (97)

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Space heating kWh	503.0638	388.3720	326.2590	197.3662	100.6060	0.0000	0.0000	0.0000	0.0000	179.4876	349.6040	515.7419 (98a)
Space heating requirement - total per year (kWh/year)												2560.5004
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	503.0638	388.3720	326.2590	197.3662	100.6060	0.0000	0.0000	0.0000	0.0000	179.4876	349.6040	515.7419 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2560.5004
Space heating per m2										(98c) / (4) =		52.3299 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	503.0638	388.3720	326.2590	197.3662	100.6060	0.0000	0.0000	0.0000	0.0000	179.4876	349.6040	515.7419 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	295.9199	228.4541	191.9170	116.0978	59.1800	0.0000	0.0000	0.0000	0.0000	105.5809	205.6494	303.3776 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Lighting	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)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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												1506.1767 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1208.7362 (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)												122.5729 (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												2837.4859 (238)

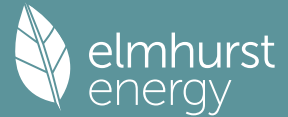
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1506.1767	16.4900	248.3685 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1208.7362	16.4900	199.3206 (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	122.5729	16.4900	20.2123 (250)
Additional standing charges			0.0000 (251)
Total energy cost			467.9014 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		1.7933 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	70.9306
SAP rating (Section 12)		71 (258)
SAP band		C

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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	1506.1767	0.1550	233.4273 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1208.7362	0.1412	170.6246 (264)
Space and water heating			404.0519 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Total CO ₂ , kg/year			421.7429 (272)
CO ₂ emissions per m ²			8.6200 (273)
EI value			93.9834
EI rating			94 (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	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6402 (5)
Dwelling volume			

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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)

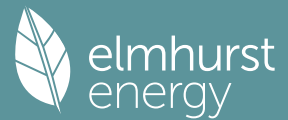
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.3868	0.3780	0.3780	0.3341	0.3341	0.2901	0.2901	0.2989	0.2989	0.3253	0.3341	0.3517 (22b)
Effective ac	0.5748	0.5715	0.5715	0.5558	0.5558	0.5421	0.5421	0.5447	0.5447	0.5529	0.5558	0.5618 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.3000 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10652.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	1.0000	5.7700	
E3 Sill				5.7700	0.1000	0.5770	
E4 Jamb				9.6400	0.1000	0.9640	
E5 Ground floor (normal)				22.8400	0.3200	7.3088	
E16 Corner (normal)				12.5600	0.1800	2.2608	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8806 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	52.0369 (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
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(38)m	29.1440	28.9735	28.9735	28.1800	28.1800	27.4844	27.4844	27.6157	27.6157	28.0330	28.1800	28.4856 (38)
Heat transfer coeff	81.1809	81.0105	81.0105	80.2169	80.2169	79.5213	79.5213	79.6526	79.6526	80.0700	80.2169	80.5226 (39)
Average = Sum(39)m / 12 =												80.2327
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6591	1.6556	1.6556	1.6394	1.6394	1.6252	1.6252	1.6279	1.6279	1.6364	1.6394	1.6457 (40)
HLP (average)												1.6397
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6586 (42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												90.3022 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Energy content (annual)												Total = Sum(45)m = 1500.0391
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
												Total per year (kWh/year) = Sum(64)m = 2054.8515 (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	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3515	15.4114	12.5334	9.4886	7.0928	5.9881	6.4703	8.4104	11.2884	14.3332	16.7290	17.8337 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains	438.8839	437.3476	425.3348	402.6716	380.4502	348.7314	336.7232	338.9166	350.3491	382.3065	407.1568	428.8828 (73)

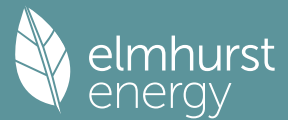
6. Solar gains

[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	
South						6.8900	51.7504	0.6300	0.7000			0.7700			108.9694	(78)
West						3.3200	22.4175	0.6300	0.7000			0.7700			22.7456	(80)
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889			111.8388	(83)	
Total gains	570.5989	644.7295	699.5837	740.8430	742.6470	722.3618	694.4709	673.8641	657.4275	620.5008	568.4457			540.7216	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.4504	36.5271	36.5271	36.8885	36.8885	37.2111	37.2111	37.1498	37.1498	36.9562	36.8885	36.7484
alpha	3.4300	3.4351	3.4351	3.4592	3.4592	3.4807	3.4807	3.4767	3.4767	3.4637	3.4592	3.4499
util living area	0.9685	0.9514	0.9188	0.8548	0.7510	0.5748	0.4009	0.4127	0.6555	0.8571	0.9469	0.9733 (86)
MIT	19.6051	19.7906	20.0814	20.4162	20.6777	20.8480	20.8984	20.8970	20.8064	20.4899	19.9909	19.5632 (87)
Th 2	19.5703	19.5728	19.5728	19.5846	19.5846	19.5949	19.5949	19.5929	19.5929	19.5867	19.5846	19.5800 (88)

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util rest of house	0.9596	0.9379	0.8956	0.8121	0.6754	0.4538	0.2498	0.2575	0.5404	0.8056	0.9295	0.9656 (89)
MIT 2	18.0166	18.2486	18.6058	19.0103	19.2935	19.4519	19.4791	19.4767	19.4225	19.1058	18.5112	17.9715 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	19.0691	19.2703	19.5835	19.9418	20.2107	20.3769	20.4195	20.4178	20.3395	20.0229	19.4916	19.0262 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0691	19.2703	19.5835	19.9418	20.2107	20.3769	20.4195	20.4178	20.3395	20.0229	19.4916	19.0262 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9558	0.9345	0.8959	0.8240	0.7113	0.5238	0.3401	0.3503	0.6049	0.8234	0.9282	0.9619	(94)
Useful gains	545.3619	602.5063	626.7232	610.4876	528.2368	378.3475	236.1842	236.0371	397.6480	510.9219	527.6200	520.1359	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	1182.7362	1147.9433	1027.4978	845.6311	634.5683	403.7236	240.1148	240.3739	441.2333	706.4481	969.9517	1177.7363	(97)
Space heating kWh	474.2065	366.5337	298.1763	169.3033	79.1106	0.0000	0.0000	0.0000	0.0000	145.4715	318.4789	489.2547	(98a)
Space heating requirement - total per year (kWh/year)												2340.5355	
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	474.2065	366.5337	298.1763	169.3033	79.1106	0.0000	0.0000	0.0000	0.0000	145.4715	318.4789	489.2547	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2340.5355	
Space heating per m2										(98c) / (4) =		47.8344	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	474.2065	366.5337	298.1763	169.3033	79.1106	0.0000	0.0000	0.0000	0.0000	145.4715	318.4789	489.2547	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	278.9450	215.6080	175.3979	99.5902	46.5357	0.0000	0.0000	0.0000	0.0000	85.5715	187.3405	287.7969	(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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532	(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	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098	(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												1376.7856	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1208.7362	(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)												122.5729	(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												2708.0948	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
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Space heating - main system 1	1376.7856	28.4300	391.4201 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1208.7362	28.4300	343.6437 (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	122.5729	28.4300	34.8475 (250)
Additional standing charges			0.0000 (251)
Total energy cost			769.9113 (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	1376.7856	0.1555	214.0223 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1208.7362	0.1412	170.6246 (264)
Space and water heating			384.6469 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Total CO2, kg/year			402.3380 (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	1376.7856	1.5755	2169.1311 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1208.7362	1.5220	1839.6663 (278)
Space and water heating			4008.7974 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	122.5729	1.5338	188.0065 (282)
Total Primary energy kWh/year			4196.8039 (286)

SAP 10 EPC IMPROVEMENTS

Baseline annex dwelling

Current energy efficiency rating: C 71
Current environmental impact rating: A 94

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 3.0	-£ 93	-41 kg (10.1%)
U Solar photovoltaic panels	+ 7.8	-£ 222	-107 kg (29.5%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£93	0.83 kg/m²	C 74 A 95
Solar photovoltaic panels	£222	2.18 kg/m²	B 82 A 96
Total Savings	£315	3.01 kg/m²	

Potential energy efficiency rating: B 82
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

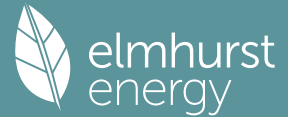
	Current	Potential	Saving
Electricity	£770	£677	£93
Space heating	£391	£416	-£24
Water heating	£344	£227	£117
Lighting	£35	£35	£0
Generated (PV)	-£0	-£222	£222
Total cost of fuels	£770	£455	£315
Total cost of uses	£770	£456	£315
Delivered energy	55 kWh/m²	33 kWh/m²	23 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.3 tonnes	0.1 tonnes
CO2 emissions per m²	8 kg/m²	5 kg/m²	3 kg/m²
Primary energy	86 kWh/m²	52 kWh/m²	34 kWh/m²

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 (m2)	Storey height (m)	Volume (m3)
Main dwelling			

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Ground floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 48.9300 48.9300 (1b) x 3.1400 (2b) = 153.6402 (1b) - (3b)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6402 (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 2 * 10 = 20.0000 (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) = 20.0000 / (5) = 0.1302 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3802 (18)
Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.3000 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum (A, m2)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10652.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	1.0000	5.7700	
E3 Sill				5.7700	0.1000	0.5770	
E4 Jamb				9.6400	0.1000	0.9640	
E5 Ground floor (normal)				22.8400	0.3200	7.3088	
E16 Corner (normal)				12.5600	0.1800	2.2608	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8806 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	52.0369 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Heat transfer coeff	82.4839	82.2860	82.0920	81.1809	81.0105	80.2169	80.2169	80.0700	80.5226	81.0105	81.3553	81.7158 (39)
Average = Sum(39)m / 12 =												81.1801

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6858	1.6817	1.6777	1.6591	1.6556	1.6394	1.6394	1.6364	1.6457	1.6556	1.6627	1.6701 (40)
HLP (average)												1.6591
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6586 (42)

Hot water usage for mixer showers 66.7705 65.7671 64.3049 61.5072 59.4426 57.1402 55.8315 57.2826 58.8734 61.3454 64.2032 66.5147 (42a)

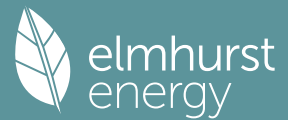
Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)

Hot water usage for other uses 31.6162 30.4665 29.3168 28.1672 27.0175 25.8678 25.8678 27.0175 28.1672 29.3168 30.4665 31.6162 (42c)

Average daily hot water use (litres/day) 90.3022 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Energy content (annual)										Total = Sum(45)m =		1500.0391
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)

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If cylinder contains dedicated solar storage											
	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000 (57)
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	31.1612 (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											
	205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304 (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)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector linear heat loss coefficient											0.8000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector loop efficiency											0.0000 (H4)
Incidence angle modifier											0.9000 (H5)
Overshading factor											1.0000 (H6)
Overall heat loss coefficient of system											0.8000 (H8)
Heat loss coefficient of collector loop											6.5000 (H10)
Dedicated solar storage volume											3.9667 (H11)
Effective solar volume											75.0000 (H12)
Reference volume											75.0000 (H14)
Storage tank correction coefficient											225.0000 (H15)
Heat delivered to hot water											1.3161 (H16)
Heat delivered to space heating											570.7779 (H24)
Solar input											0.0000 (H29)
Solar input	-0.0000	-16.2883	-56.1098	-74.9805	-94.4978	-85.6431	-84.6727	-75.8290	-54.3789	-28.3777	-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	205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304 (64)
Total per year (kWh/year) = Sum(64)m =											203.4104 (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 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705 (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	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3515	15.4114	12.5334	9.4886	7.0928	5.9881	6.4703	8.4104	11.2884	14.3332	16.7290	17.8337 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738 (72)
Total internal gains	438.8839	437.3476	423.3244	392.6196	362.0216	334.7239	322.7158	325.9096	344.3459	380.2961	407.1568	428.8828 (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
South				6.8900	46.7521		0.6300		0.7000		0.7700		98.4446 (78)
West				3.3200	19.6403		0.6300		0.7000		0.7700		19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379		101.4528 (83)
Total gains	557.2562	637.5573	692.8980	718.3679	718.6504	684.9663	661.9849	642.8447	633.5500	600.4508	548.6947		530.3355 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.8746	35.9609	36.0459	36.4504	36.5271	36.8885	36.8885	36.9562	36.7484	36.5271	36.3723	36.2118
alpha	3.3916	3.3974	3.4031	3.4300	3.4351	3.4592	3.4592	3.4637	3.4499	3.4351	3.4248	3.4141
util living area	0.9718	0.9550	0.9270	0.8775	0.7925	0.6538	0.5031	0.5342	0.7219	0.8845	0.9549	0.9758 (86)
MIT	19.5295	19.7268	20.0036	20.3265	20.6051	20.8019	20.8778	20.8696	20.7474	20.3936	19.9041	19.4940 (87)
Th 2	19.5511	19.5540	19.5568	19.5703	19.5728	19.5846	19.5846	19.5867	19.5800	19.5728	19.5677	19.5624 (88)
util rest of house	0.9638	0.9424	0.9061	0.8406	0.7263	0.5422	0.3547	0.3870	0.6206	0.8421	0.9401	0.9688 (89)
MIT 2	17.9078	18.1554	18.4990	18.8967	19.2110	19.4096	19.4605	19.4590	19.3629	18.9866	18.3920	17.8715 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9823	19.1966	19.4959	19.8441	20.1347	20.3321	20.3996	20.3936	20.2803	19.9188	19.3939	18.9465 (91)
Temperature adjustment	0.0000											
adjusted MIT	18.9823	19.1966	19.4959	19.8441	20.1347	20.3321	20.3996	20.3936	20.2803	19.9188	19.3939	18.9465 (92)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9599	0.9387	0.9051	0.8486	0.7546	0.6044	0.4429	0.4741	0.6742	0.8539	0.9379	0.9651 (94)
Useful gains	534.8899	598.4730	627.1535	609.5836	542.3008	413.9862	293.1851	304.7982	427.1702	512.7000	514.6154	511.8229 (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	1211.0509	1176.4074	1066.8632	888.4504	683.3021	459.8090	304.7923	319.7696	497.6502	754.9220	1000.1765	1205.0244 (97)
Space heating kWh	503.0638	388.3720	327.1441	200.7841	104.9050	0.0000	0.0000	0.0000	0.0000	180.2132	349.6040	515.7419 (98a)
Space heating requirement - total per year (kWh/year)												2569.8280

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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	503.0638	388.3720	327.1441	200.7841	104.9050	0.0000	0.0000	0.0000	0.0000	180.2132	349.6040	515.7419 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2569.8280
Space heating per m2										(98c) / (4) =		52.5205 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	503.0638	388.3720	327.1441	200.7841	104.9050	0.0000	0.0000	0.0000	0.0000	180.2132	349.6040	515.7419 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	295.9199	228.4541	192.4377	118.1083	61.7088	0.0000	0.0000	0.0000	0.0000	106.0078	205.6494	303.3776 (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	205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304	203.4104 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	97.4663	79.8087	51.1108	32.0686	26.0766	25.2771	34.3048	51.7999	83.8481	107.6649	119.6532 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-37.6589	-55.4797	-81.1582	-89.1311	-88.7486	-71.0137	-70.0416	-68.1233	-63.4723	-61.3328	-41.8474	-32.3025 (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												1511.6635 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												830.0093 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												122.5729 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-760.3101 (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												1783.9357 (238)

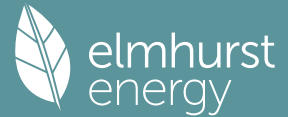
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1511.6635	16.4900	249.2733 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	830.0093	16.4900	136.8685 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	122.5729	16.4900	20.2123 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-760.3101	16.4900	-125.3751
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-125.3751 (252)
Total energy cost			294.1710 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
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Full SAP Calculation Printout



Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.1275 (257)
 SAP value 81.7240
 SAP rating (Section 12) 82 (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	1511.6635	0.1549	234.1863 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	830.0093	0.1474	122.3198 (264)
Space and water heating			356.5060 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-760.3101	0.1361	-103.4881
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-103.4881 (269)
Total CO2, kg/year			281.8060 (272)
CO2 emissions per m2			5.7600 (273)
EI value			95.9798
EI rating			96 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.3868	0.3780	0.3780	0.3341	0.3341	0.2901	0.2901	0.2989	0.2989	0.3253	0.3341	0.3517 (22b)
Effective ac	0.5748	0.5715	0.5715	0.5558	0.5558	0.5421	0.5421	0.5447	0.5447	0.5529	0.5558	0.5618 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.3000 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m2)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10652.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.7127 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	1.0000	5.7700	
E3 Sill				5.7700	0.1000	0.5770	

elmhurst
energy

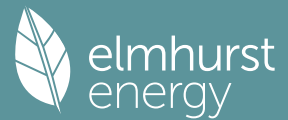
Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$												
(38)m	Jan 29.1440	Feb 28.9735	Mar 28.9735	Apr 28.1800	May 28.1800	Jun 27.4844	Jul 27.4844	Aug 27.6157	Sep 27.6157	Oct 28.0330	Nov 28.1800	Dec 28.4856 (38)
Heat transfer coeff	81.1809	81.0105	81.0105	80.2169	80.2169	79.5213	79.5213	79.6526	79.6526	80.0700	80.2169	80.5226 (39)
Average = Sum(39)m / 12 =	80.2327											
HLP	Jan 1.6591	Feb 1.6556	Mar 1.6556	Apr 1.6394	May 1.6394	Jun 1.6252	Jul 1.6252	Aug 1.6279	Sep 1.6279	Oct 1.6364	Nov 1.6394	Dec 1.6457 (40)
HLP (average)	1.6397											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												1.6586 (42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												90.3022 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612 (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	205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304	203.4104 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												625.3455 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												625.3455
Solar input	-0.0000	-19.3083	-59.6151	-80.5194	-97.7685	-92.6874	-90.7902	-82.8081	-61.3341	-35.8541	-4.6602	-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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)
	Total per year (kWh/year) = Sum(64a) m =											1356.4482 (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) = Sum(64a) m =											0.0000 (64a)
Heat gains from water heating, kWh/month	91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705	90.8973 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3515	15.4114	12.5334	9.4886	7.0928	5.9881	6.4703	8.4104	11.2884	14.3332	16.7290	17.8337 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738 (72)
Total internal gains	438.8839	437.3476	423.3244	392.6196	362.0216	334.7239	322.7158	325.9096	344.3459	380.2961	407.1568	428.8828 (73)

[Jan]	Area	Solar flux	α	FF	Access	Gains
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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
South				6.8900	51.7504	0.6300		0.7000		0.7700		108.9694 (78)
West				3.3200	22.4175	0.6300		0.7000		0.7700		22.7456 (80)
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889	111.8388 (83)
Total gains	570.5989	644.7295	697.5733	730.7910	724.2183	708.3544	680.4634	660.8572	651.4243	618.4904	568.4457	540.7216 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.4504	36.5271	36.5271	36.8885	36.8885	37.2111	37.2111	37.1498	37.1498	36.9562	36.8885	36.7484
alpha	3.4300	3.4351	3.4351	3.4592	3.4592	3.4807	3.4807	3.4767	3.4767	3.4637	3.4592	3.4499
util living area	0.9685	0.9514	0.9194	0.8589	0.7612	0.5836	0.4085	0.4201	0.6596	0.8581	0.9469	0.9733 (86)
MIT	19.6051	19.7906	20.0790	20.4069	20.6669	20.8449	20.8976	20.8962	20.8043	20.4881	19.9909	19.5632 (87)
Th 2	19.5703	19.5728	19.5728	19.5846	19.5846	19.5949	19.5949	19.5929	19.5929	19.5867	19.5846	19.5800 (88)
util rest of house	0.9596	0.9379	0.8963	0.8169	0.6864	0.4617	0.2548	0.2624	0.5444	0.8068	0.9295	0.9656 (89)
MIT 2	18.0166	18.2486	18.6030	19.0003	19.2840	19.4503	19.4789	19.4766	19.4212	19.1039	18.5112	17.9715 (90)
Living area fraction	fLA = Living area / (4) =											0.6626 (91)
MIT	19.0691	19.2703	19.5810	19.9323	20.2003	20.3743	20.4189	20.4172	20.3376	20.0210	19.4916	19.0262 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0691	19.2703	19.5810	19.9323	20.2003	20.3743	20.4189	20.4172	20.3376	20.0210	19.4916	19.0262 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9558	0.9345	0.8965	0.8284	0.7214	0.5321	0.3467	0.3567	0.6088	0.8244	0.9282	0.9619 (94)
Useful gains	545.3619	602.5063	625.3660	605.3577	522.4780	376.8858	235.8954	235.7357	396.6077	509.9062	527.6200	520.1359 (95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)
Heat loss rate W	1182.7362	1147.9433	1027.2913	844.8662	633.7353	403.5178	240.0694	240.3265	441.0861	706.2971	969.9517	1177.7363 (97)
Space heating kWh	474.2065	366.5337	299.0325	172.4461	82.7755	0.0000	0.0000	0.0000	0.0000	146.1148	318.4789	489.2547 (98a)
Space heating requirement - total per year (kWh/year)												2348.8426
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	474.2065	366.5337	299.0325	172.4461	82.7755	0.0000	0.0000	0.0000	0.0000	146.1148	318.4789	489.2547 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2348.8426
Space heating per m2	(98c) / (4) =											48.0041 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	474.2065	366.5337	299.0325	172.4461	82.7755	0.0000	0.0000	0.0000	0.0000	146.1148	318.4789	489.2547 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	278.9450	215.6080	175.9015	101.4389	48.6914	0.0000	0.0000	0.0000	0.0000	85.9499	187.3405	287.7969 (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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	95.6898	77.7468	47.8527	30.1447	21.9329	21.6785	30.1994	47.7086	79.4502	104.9236	119.6532 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-41.5819	-57.4189	-82.1618	-89.8039	-87.2624	-71.9805	-70.8425	-69.3153	-65.4521	-64.2420	-46.7285	-35.4483 (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												1381.6721 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	170.0000	
Water heating fuel used	797.9107 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans:		
pump for solar water heating	80.0000 (230g)	
Total electricity for the above, kWh/year	80.0000 (231)	
Electricity for lighting (calculated in Appendix L)	122.5729 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-782.2380 (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	1599.9178 (238)	

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1381.6721	28.4300	392.8094 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	797.9107	28.4300	226.8460 (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)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	122.5729	28.4300	34.8475 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.2380	28.4300	-222.3903
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-222.3903 (252)
Total energy cost			454.8566 (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	1381.6721	0.1554	214.6998 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	797.9107	0.1481	118.1325 (264)
Space and water heating			332.8323 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.2380	0.1364	-106.7168
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-106.7168 (269)
Total CO2, kg/year			254.9035 (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	1381.6721	1.5753	2176.5240 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	797.9107	1.5478	1234.9723 (278)
Space and water heating			3411.4964 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	122.5729	1.5338	188.0065 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-782.2380	1.5043	-1176.7478
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1176.7478 (283)
Total Primary energy kWh/year			2543.7791 (286)

ii. Be Lean

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Plot Reference	BASE/BELEAN/BEGREEN			Issued on Date	27/01/2026
Assessment Reference	BE LEAN main dwelling	Plot Type Ref	Flint House		
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD			SAP Version	10.2
SAP Rating	74 C	DER	4.87	TER	8.52
Environmental	95 A	% DER < TER			42.84
CO ₂ Emissions (t/year)	1.06	DFEE	43.26	TFEE	44.85
Compliance Check	See BREL	% DFEE < TFEE			3.53
% DPER < TPER	-10.97	DPER	50.09	TPER	45.14
Assessor Details	Mr. Neil Bradford			Assessor ID	T704-0001
Client	Flint House, Joe Reader				

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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (5)

2. Ventilation rate

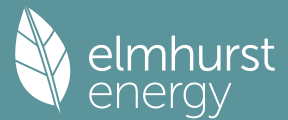
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2597 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2597 (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	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (22b)
Effective ac	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

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

(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
107.3765 (35)

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.8404 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			169.8914 (37)
			(33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080 (38)
Heat transfer coeff	292.6267	292.1559	291.6944	289.5269	289.1213	287.2335	287.2335	286.8839	287.9606	289.1213	289.9417	290.7994 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												289.5249
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

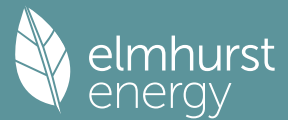
Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers													
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)		
Hot water usage for baths													
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)		
Hot water usage for other uses													
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)		
Average daily hot water use (litres/day)												141.2695 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)		
Energy content (annual)	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)	
Distribution loss (46)m = 0.15 x (45)m													
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)		
Water storage loss (or HIU loss):													
Store volume												200.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												0.8400 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.5040 (55)	
Total storage loss													
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (56)		
If cylinder contains dedicated solar storage													
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (57)		
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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													
290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924 (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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924 (64)	
12Total per year (kWh/year)												2866.2299 (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	118.3577	105.0175	112.2470	100.0947	98.0313	83.2916	82.6014	85.4657	85.9586	101.4059	106.3131	117.2306 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	159.0829	156.2761	150.8696	139.0205	131.7625	115.6827	111.0234	114.8733	119.3870	136.2982	147.6570	157.5679 (72)
Total internal gains	837.9229	861.1131	823.3443	795.8141	753.4116	714.4630	685.2121	684.8742	706.7261	742.3184	788.8218	818.6015 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.1100				10.6334		0.6300		0.7000		0.7700		23.1054 (74)	
East	21.7500				19.6403		0.6300		0.7000		0.7700		130.5505 (76)	
South	19.3500				46.7521		0.6300		0.7000		0.7700		276.4736 (78)	
West	27.3600				19.6403		0.6300		0.7000		0.7700		164.2235 (80)	
East	1.6900				26.6072		0.6300		0.7000		1.0000		17.8471 (82)	
West	1.6900				26.6072		0.6300		0.7000		1.0000		17.8471 (82)	
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)	
Total gains	1467.9700	2006.8648	2549.4866	3144.3041	3534.8659	3531.3946	3378.6966	3053.9974	2651.9439	2054.6531	1557.5143	1348.2556	(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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456		
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097		
util living area	0.9689	0.9345	0.8733	0.7614	0.6192	0.4711	0.3559	0.4038	0.6136	0.8438	0.9472	0.9746	(86)	
MIT	18.7916	19.1745	19.6722	20.2108	20.5798	20.7774	20.8463	20.8311	20.6649	20.1112	19.3355	18.7222	(87)	
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919	(88)	
util rest of house	0.9638	0.9243	0.8544	0.7280	0.5691	0.4032	0.2736	0.3172	0.5447	0.8125	0.9373	0.9704	(89)	
MIT 2	17.8695	18.2458	18.7277	19.2370	19.5633	19.7269	19.7726	19.7663	19.6476	19.1630	18.4150	17.8055	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	18.0788	18.4566	18.9421	19.4580	19.7940	19.9653	20.0163	20.0079	19.8784	19.3782	18.6239	18.0135	(92)	
Temperature adjustment	0.0000													
adjusted MIT	18.0788	18.4566	18.9421	19.4580	19.7940	19.9653	20.0163	20.0079	19.8784	19.3782	18.6239	18.0135	(93)	
8. Space heating requirement														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9528	0.9079	0.8353	0.7132	0.5640	0.4072	0.2824	0.3257	0.5431	0.7951	0.9225	0.9608	(94)	
Useful gains	1398.6335	1822.1228	2129.5841	2242.6061	1993.7641	1437.8739	954.0036	994.5853	1440.3684	1633.6538	1436.8304	1295.3663	(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	4032.0398	3960.6286	3629.2773	3056.8253	2340.1388	1541.0937	981.2719	1035.0625	1663.9607	2537.9588	3341.2513	4016.9685	(97)	
Space heating kWh	1959.2543	1437.0759	1115.7718	586.2378	257.7027	0.0000	0.0000	0.0000	0.0000	672.8029	1371.1831	2024.8721	(98a)	
Space heating requirement - total per year (kWh/year)													9424.9005	
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	1959.2543	1437.0759	1115.7718	586.2378	257.7027	0.0000	0.0000	0.0000	0.0000	672.8029	1371.1831	2024.8721	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													9424.9005	
Space heating per m2	(98c) / (4) =											40.0361 (99)		
9a. Energy requirements - Individual heating systems, including micro-CHP														
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)	
Fraction of space heat from main system(s)													1.0000 (202)	
Efficiency of main space heating system 1 (in %)													170.0000 (206)	
Efficiency of main space heating system 2 (in %)													0.0000 (207)	
Efficiency of secondary/supplementary heating system, %													0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1959.2543	1437.0759	1115.7718	586.2378	257.7027	0.0000	0.0000	0.0000	0.0000	672.8029	1371.1831	2024.8721	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	1152.5025	845.3387	656.3363	344.8458	151.5898	0.0000	0.0000	0.0000	0.0000	395.7664	806.5783	1191.1012	(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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924	(64)	
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	170.6954	150.8396	159.8848	139.6341	134.7354	116.2293	113.9708	119.0382	120.9477	140.7055	150.6352	168.7014	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	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	39.3551	31.5722	28.4272	20.8270	16.0874	13.1435	14.6754	19.0757	24.7774	32.5093	36.7192	40.4489	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	

Full SAP Calculation Printout



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												5544.0591	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1686.0176	(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)												317.6186	(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												7547.6953	(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	5544.0591	0.1556	862.6214	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1686.0176	0.1413	238.2392	(264)
Space and water heating			1100.8606	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	317.6186	0.1443	45.8422	(268)
Total CO2, kg/year			1146.7028	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8700	(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	5544.0591	1.5760	8737.5051	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1686.0176	1.5225	2566.9801	(278)
Space and water heating			11304.4853	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	317.6186	1.5338	487.1739	(282)
Total Primary energy kWh/year			11791.6592	(286)
Dwelling Primary energy Rate (DPER)			50.0900	(287)

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

1. Overall dwelling characteristics

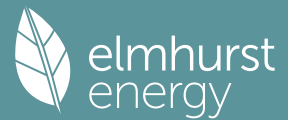
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)	
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (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) = 0.0597 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3097 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3097 (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 infiltr rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (22b)
Effective ac	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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 Opening Type			56.3500	1.1450	64.5229		(27)
TER Roof Light			2.5200	1.5918	5.0956		(27a)
GF			122.0000	0.1300	15.8600		(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152		(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284		(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496		(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756		(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983		(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959		(30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		138.4415		(33)

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

107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0500	2.0110
E3 Sill	40.2200	0.0500	2.0110
E4 Jamb	65.3800	0.0500	3.2690
E5 Ground floor (normal)	46.4800	0.1600	7.4368
E6 Intermediate floor within a dwelling	46.5100	0.0000	0.0000
E16 Corner (normal)	22.9200	0.0900	2.0628
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0800	1.2560
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0800	0.3808
E14 Flat roof	7.4210	0.0800	0.5937
R2 Sill of roof window	4.7600	0.0600	0.2856
R3 Jamb of roof window	2.8600	0.0800	0.2288
E11 Eaves (insulation at rafter level)	22.3000	0.0400	0.8920
R4 Ridge (vaulted ceiling)	20.9000	0.0800	1.6720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.6619 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	162.1033 (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	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2180	122.8687	124.0354	125.2552 (38)
Average = Sum(39)m / 12 =	289.9573	289.2877	288.6314	285.5488	284.9720	282.2871	282.2871	281.7899	283.3213	284.9720	286.1388	287.3586 (39)
												285.5460

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2317	1.2289	1.2261	1.2130	1.2105	1.1991	1.1991	1.1970	1.2035	1.2105	1.2155	1.2207 (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												3.0480 (42)
Hot water usage for mixer showers												
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)	
Hot water usage for baths												
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)	
Hot water usage for other uses												
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)	
Average daily hot water use (litres/day)												141.2695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Energy content (annual)										Total = Sum(45)m =		2346.4575

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

36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)
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Water storage loss (or HIU loss):

Store volume

200.0000 (47)

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

Temperature factor from Table 2b

1.6525 (48)

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

0.5400 (49)

Total storage loss

0.8924 (55)

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
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If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
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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)
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Total heat required for water heating calculated for each month

294.3231	260.1675	275.9450	241.3853	233.1911	209.2411	205.7901	214.4046	217.2624	243.3403	260.0871	290.9333 (62)
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WWHRS	-34.4351	-30.4547	-31.8904	-26.4065	-24.6099	-21.0589	-19.7393	-20.9908	-21.7883	-25.6860	-29.0991	-33.7974 (63a)
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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)
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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)
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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)
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Output from w/h	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359 (64)
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12Total per year (kWh/year)

2626.1147 (64)

Electric shower(s)

2626 (64)

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

0.0000 (64a)

Heat gains from water heating, kWh/month

121.6704	108.0096	115.5597	103.3006	101.3440	92.6126	92.2332	95.0975	95.2797	104.7186	109.5189	120.5432 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	163.5355	160.7286	155.3221	143.4730	136.2150	128.6286	123.9693	127.8192	132.3329	140.7508	152.1096	162.0205 (72)
Total internal gains	842.3755	865.5657	827.7969	800.2667	757.8641	727.4089	698.1580	697.8201	719.6720	746.7709	793.2743	823.0540 (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	
North	5.3000		10.6334		0.6300		0.7000		0.7700		17.2234 (74)	
East	16.2300		19.6403		0.6300		0.7000		0.7700		97.4177 (76)	
South	14.4300		46.7521		0.6300		0.7000		0.7700		206.1764 (78)	
West	20.3900		19.6403		0.6300		0.7000		0.7700		122.3873 (80)	
East	1.2600		26.6072		0.6300		0.7000		1.0000		13.3061 (82)	
West	1.2600		26.6072		0.6300		0.7000		1.0000		13.3061 (82)	
Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021	394.9560 (83)
Total gains	1312.1925	1719.9317	2114.9390	2551.4630	2831.8961	2827.8898	2706.5911	2464.3971	2170.1682	1725.3520	1366.4765	1218.0100 (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	24.2157	24.2718	24.3270	24.5896	24.6394	24.8737	24.8737	24.9176	24.7829	24.6394	24.5389	24.4347
alpha	2.6144	2.6181	2.6218	2.6393	2.6426	2.6582	2.6582	2.6612	2.6522	2.6426	2.6359	2.6290
util living area	0.9758	0.9522	0.9097	0.8242	0.7010	0.5519	0.4257	0.4761	0.6873	0.8838	0.9599	0.9798 (86)
MIT	18.1236	18.5592	19.1707	19.9013	20.4592	20.7992	20.9266	20.8997	20.6223	19.8300	18.8360	18.0547 (87)
Th 2	19.8947	19.8970	19.8992	19.9096	19.9116	19.9207	19.9207	19.9224	19.9172	19.9116	19.9076	19.9035 (88)
util rest of house	0.9717	0.9445	0.8951	0.7960	0.6533	0.4797	0.3325	0.3806	0.6205	0.8583	0.9521	0.9765 (89)
MIT 2	16.5304	17.0821	17.8496	18.7493	19.4002	19.7685	19.8816	19.8651	19.6019	18.6881	17.4454	16.4476 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8919	17.4173	18.1494	19.0108	19.6405	20.0024	20.1187	20.0999	19.8335	18.9472	17.7609	16.8123 (92)
Temperature adjustment												
adjusted MIT	16.8919	17.4173	18.1494	19.0108	19.6405	20.0024	20.1187	20.0999	19.8335	18.9472	17.7609	16.8123 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9548	0.9198	0.8648	0.7684	0.6401	0.4855	0.3504	0.3972	0.6148	0.8295	0.9297	0.9615 (94)
Useful gains	1252.8222	1582.0234	1828.8937	1960.4999	1812.6326	1373.0654	948.3664	978.8965	1334.1647	1431.2053	1270.4638	1171.1118 (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	3651.1185	3621.0966	3362.3796	2887.1142	2262.8280	1525.0214	993.2893	1042.5851	1624.4198	2378.7260	3050.5087	3624.2459 (97)
Space heating kWh	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318 (98a)
Space heating requirement - total per year (kWh/year)												
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)												
Space heating kWh	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
Space heating per m2	(98c) / (4) =											

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	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318 (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)	1933.1879	1484.5690	1236.0926	722.8195	362.8877	0.0000	0.0000	0.0000	0.0000	763.7653	1388.5507	1977.3909 (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

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Water heating requirement	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.5448	87.3850	87.0696	86.4246	85.1161	79.8000	79.8000	79.8000	79.8000	86.4986	87.2965	87.5802 (217)
Fuel for water heating, kWh/month	296.8631	262.8744	280.2984	248.7473	245.0549	235.8174	233.1463	242.3732	244.9550	251.6276	264.6015	293.6003 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-98.3357	-131.3023	-178.7761	-189.9062	-195.6573	-179.1549	-176.5667	-170.7699	-159.7637	-144.2435	-105.2937	-85.8686 (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	-80.2964	-165.2852	-322.2035	-475.2415	-620.4428	-620.8396	-613.8577	-523.6274	-388.8196	-233.7950	-106.2978	-63.8108 (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												9869.2636 (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												3099.9594 (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)												341.3397 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-6030.1557 (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												7366.4070 (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	9869.2636	0.2100	2072.5454 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3099.9594	0.2100	650.9915 (264)
Space and water heating			2723.5368 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	341.3397	0.1443	49.2659 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1815.6384	0.1358	-246.6011
PV Unit electricity exported	-4214.5173	0.1264	-532.8271
Total			-779.4282 (269)
Total CO2, kg/year			2005.3037 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.5200 (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	9869.2636	1.1300	11152.2678 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3099.9594	1.1300	3502.9541 (278)
Space and water heating			14655.2220 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	341.3397	1.5338	523.5583 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1815.6384	1.5020	-2727.1576
PV Unit electricity exported	-4214.5173	0.4641	-1955.9374
Total			-4683.0951 (283)
Total Primary energy kWh/year			10625.7860 (286)
Target Primary Energy Rate (TPER)			45.1400 (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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 670.3694 (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)	
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.0597 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000 (17)	
Infiltration rate												0.2597 (18)	
Number of sides sheltered												0 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2597 (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	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (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	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (25)	

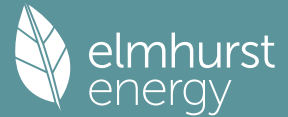
3. Heat losses and heat loss parameter

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								
Windows			75.5700	1.1450	86.5305			(27)
Rooflights			3.3800	1.3258	4.4811			(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000	(28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400	(29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400	(29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800	(29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600	(29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300	(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100	(30)
Total net area of external elements Aum(A, m2)			536.2500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510			(33)
Main dwelling								
GF			169.3300			9.0000	1523.9700	(32c)
1ST MASTER			37.7600			9.0000	339.8400	(32c)
1ST BEDROOM			107.2800			9.0000	965.5200	(32c)
1ST LAND			148.6600			9.0000	1337.9400	(32c)
FF			113.4100			18.0000	2041.3800	(32d)
GF			113.4100			9.0000	1020.6900	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								107.3765 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				40.2200	0.0620		2.4936	
E3 Sill				40.2200	0.0390		1.5686	
E4 Jamb				65.3800	0.0520		3.3998	
E5 Ground floor (normal)				46.4800	0.0750		3.4860	
E6 Intermediate floor within a dwelling				46.5100	0.0630		2.9301	
E16 Corner (normal)				22.9200	0.0360		0.8251	
R11 Upstands or kerbs of rooflights				12.3600	0.0800		0.9888	
E13 Gable (insulation at rafter level)				15.7000	0.0510		0.8007	
R5 Ridge (inverted)				6.5920	0.0400		0.2637	
R8 Roof to wall (rafter)				5.1650	0.0600		0.3099	
R1 Head of roof window				4.7600	0.0410		0.1952	
E14 Flat roof				7.4210	0.0700		0.5195	
R2 Sill of roof window				4.7600	0.0370		0.1761	
R3 Jamb of roof window				2.8600	0.0430		0.1230	
E11 Eaves (insulation at rafter level)				22.3000	0.0080		0.1784	
R4 Ridge (vaulted ceiling)				20.9000	-0.0200		-0.4180	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								17.8404 (36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	169.8914	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0480 (42)
Hot water usage for mixer showers	

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Hot water usage for baths	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 other uses	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)
Average daily hot water use (litres/day)	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
												71.8231 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	78.3593	76.2093	73.8622	70.9414	68.3354	65.6273	65.0650	67.4073	69.8096	72.5906	75.5374	78.2494 (44)
Distribution loss (46)m = 0.15 x (45)m	124.1019	108.5211	113.5235	97.1152	91.9926	80.6965	78.6905	83.4644	86.0823	98.5048	107.6168	122.5196 (45)
Total = Sum(45)m =												1192.8291
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (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	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (64)
12Total per year (kWh/year)												1013.9048 (64)
Electric shower(s)	60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												686.1607 (64a)
Heat gains from water heating, kWh/month	41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398 (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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634 (72)
Total internal gains	731.5553	756.1490	721.6203	701.9032	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					7.1100	10.6334	0.6300	0.7000			0.7700	23.1054 (74)	
East					21.7500	19.6403	0.6300	0.7000			0.7700	130.5505 (76)	
South					19.3500	46.7521	0.6300	0.7000			0.7700	276.4736 (78)	
West					27.3600	19.6403	0.6300	0.7000			0.7700	164.2235 (80)	
East					1.6900	26.6072	0.6300	0.7000			1.0000	17.8471 (82)	
West					1.6900	26.6072	0.6300	0.7000			1.0000	17.8471 (82)	
Solar gains		630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541 (83)
Total gains		1361.6024	1901.9006	2447.7626	3050.3931	3445.5510	3458.4272	3309.0473	2982.1359	2577.4101	1963.2108	1458.6146	1242.9510 (84)

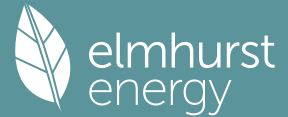
7. Mean internal temperature (heating season)

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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097
util living area	0.9737	0.9413	0.8822	0.7715	0.6293	0.4790	0.3626	0.4121	0.6248	0.8555	0.9541	0.9789 (86)
MIT	18.1348	18.6543	19.3323	20.0709	20.5790	20.8527	20.9480	20.9264	20.6952	19.9268	18.8692	18.0408 (87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)
util rest of house	0.9693	0.9320	0.8643	0.7388	0.5792	0.4104	0.2790	0.3242	0.5560	0.8257	0.9453	0.9753 (89)
MIT 2	17.2780	17.7892	18.4469	19.1447	19.5949	19.8196	19.8831	19.8736	19.7091	19.0348	18.0124	17.1890 (90)
Living area fraction	17.4724	17.9855	18.6478	19.3548	19.8182	20.0540	20.1248	20.1125	19.9328	19.2372	18.2068	17.3823 (92)
MIT	17.4724	17.9855	18.6478	19.3548	19.8182	20.0540	20.1248	20.1125	19.9328	19.2372	18.2068	17.3823 (93)
Temperature adjustment												0.0000
adjusted MIT	17.4724	17.9855	18.6478	19.3548	19.8182	20.0540	20.1248	20.1125	19.9328	19.2372	18.2068	17.3823 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9557	0.9111	0.8398	0.7207	0.5754	0.4202	0.2964	0.3415	0.5581	0.8041	0.9268	0.9636 (94)
	1301.3034	1732.8912	2055.6458	2198.4658	1982.4786	1453.4000	980.8052	1018.3666	1438.5049	1578.6576	1351.8942	1197.7370 (95)

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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	3854.6106	3823.0081	3543.4437	3026.9594	2347.1576	1566.5819	1012.4393	1065.0495	1679.6267	2497.2083	3220.3253	3833.4029 (97)
Space heating kWh	1899.6606	1404.5586	1106.9217	596.5154	271.3212	0.0000	0.0000	0.0000	0.0000	683.4017	1345.2704	1960.9354 (98a)
Space heating requirement - total per year (kWh/year)												9268.5850
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	1899.6606	1404.5586	1106.9217	596.5154	271.3212	0.0000	0.0000	0.0000	0.0000	683.4017	1345.2704	1960.9354 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9268.5850
Space heating per m2										(98c) / (4) =		39.3721 (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	2699.9945	2125.5276	2180.3173	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8416	0.8877	0.8584	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2272.1897	1886.8483	1871.4763	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3905.0180	3736.5388	3365.1785	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1175.6363	1376.1697	1111.3145	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	293.9091	344.0424	277.8286	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												915.7801 (107)
Energy for space heating												39.3721 (99)
Energy for space cooling												3.8901 (108)
Total												43.2622 (109)
Fabric Energy Efficiency (DFEE)												43.3 (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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

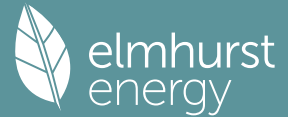
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3097 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3097 (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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (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	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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			56.3500	1.1450	64.5229		(27)
TER Opening Type							

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TER Roof Light			2.5200	1.5918	5.0956	(27a)
GF			122.0000	0.1300	15.8600	(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152	(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284	(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496	(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756	(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983	(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	(30)
Total net area of external elements Aum(A, m2)			536.2500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	138.4415		(33)

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

107.3765 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	40.2200	0.0500	2.0110
E2 Other lintels (including other steel lintels)	40.2200	0.0500	2.0110
E3 Sill	65.3800	0.0500	3.2690
E4 Jamb	46.4800	0.1600	7.4368
E5 Ground floor (normal)	46.5100	0.0000	0.0000
E6 Intermediate floor within a dwelling	22.9200	0.0900	2.0628
E16 Corner (normal)	12.3600	0.0800	0.9888
R11 Upstands or kerbs of rooflights	15.7000	0.0800	1.2560
E13 Gable (insulation at rafter level)	6.5920	0.0400	0.2637
R5 Ridge (inverted)	5.1650	0.0600	0.3099
R8 Roof to wall (rafter)	4.7600	0.0800	0.3808
R1 Head of roof window	7.4210	0.0800	0.5937
E14 Flat roof	4.7600	0.0600	0.2856
R2 Sill of roof window	2.8600	0.0800	0.2288
R3 Jamb of roof window	22.3000	0.0400	0.8920
E11 Eaves (insulation at rafter level)	20.9000	0.0800	1.6720
R4 Ridge (vaulted ceiling)			

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

23.6619 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 162.1033 (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	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2180	122.8687	124.0354	125.2552 (38)
Heat transfer coeff	289.9573	289.2877	288.6314	285.5488	284.9720	282.2871	282.2871	281.7899	283.3213	284.9720	286.1388	287.3586 (39)
Average = Sum(39)m / 12 =												285.5460

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2317	1.2289	1.2261	1.2130	1.2105	1.1991	1.1991	1.1970	1.2035	1.2105	1.2155	1.2207 (40)
HLP (average)												1.2130
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (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	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
Average daily hot water use (litres/day)												71.8231 (43)
Daily hot water use	78.3593	76.2093	73.8622	70.9414	68.3354	65.6273	65.0650	67.4073	69.8096	72.5906	75.5374	78.2494 (44)
Energy conte	124.1019	108.5211	113.5235	97.1152	91.9926	80.6965	78.6905	83.4644	86.0823	98.5048	107.6168	122.5196 (45)
Energy content (annual)										Total = Sum(45)m =		1192.8291
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):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (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	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				1013.9048 (64)
Electric shower(s)	60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221 (64a)
Heat gains from water heating, kWh/month	41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398 (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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634 (72)
Total internal gains	731.5553	756.1490	721.6203	701.9032	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969 (73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					5.3000	10.6334		0.6300	0.7000	0.7700		17.2234 (74)	
East					16.2300	19.6403		0.6300	0.7000	0.7700		97.4177 (76)	
South					14.4300	46.7521		0.6300	0.7000	0.7700		206.1764 (78)	
West					20.3900	19.6403		0.6300	0.7000	0.7700		122.3873 (80)	
East					1.2600	26.6072		0.6300	0.7000	1.0000		13.3061 (82)	
West					1.2600	26.6072		0.6300	0.7000	1.0000		13.3061 (82)	
Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021	394.9560	(83)
Total gains	1201.3723	1610.5150	2008.7624	2453.0994	2738.1287	2741.9765	2623.9960	2379.5897	2082.6885	1629.4571	1263.1241	1108.2529	(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	24.2157	24.2718	24.3270	24.5896	24.6394	24.8737	24.8737	24.9176	24.7829	24.6394	24.5389	24.4347	
alpha	2.6144	2.6181	2.6218	2.6393	2.6426	2.6582	2.6582	2.6612	2.6522	2.6426	2.6359	2.6290	
util living area	0.9802	0.9585	0.9184	0.8352	0.7135	0.5642	0.4368	0.4895	0.7028	0.8955	0.9663	0.9838	(86)
MIT	18.0406	18.4832	19.1066	19.8574	20.4337	20.7880	20.9218	20.8927	20.5997	19.7767	18.7620	17.9712	(87)
Th 2	19.8947	19.8970	19.8992	19.9096	19.9116	19.9207	19.9207	19.9224	19.9172	19.9116	19.9076	19.9035	(88)
util rest of house	0.9768	0.9517	0.9049	0.8080	0.6664	0.4915	0.3420	0.3924	0.6369	0.8719	0.9596	0.9811	(89)
MIT 2	17.1909	17.6291	18.2409	18.9658	19.4924	19.7949	19.8881	19.8743	19.6550	18.9092	17.9166	17.1275	(90)
Living area fraction	17.3837	17.8229	18.4373	19.1681	19.7060	20.0202	20.1227	20.1054	19.8694	19.1061	18.1084	17.3190	(91)
MIT	17.3837	17.8229	18.4373	19.1681	19.7060	20.0202	20.1227	20.1054	19.8694	19.1061	18.1084	17.3190	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3837	17.8229	18.4373	19.1681	19.7060	20.0202	20.1227	20.1054	19.8694	19.1061	18.1084	17.3190	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9657	0.9341	0.8819	0.7863	0.6565	0.4987	0.3606	0.4099	0.6336	0.8499	0.9441	0.9714	(94)
Useful gains	1160.1078	1504.3811	1771.5918	1928.9460	1797.6003	1367.3785	946.1883	975.3288	1319.5825	1384.9270	1192.5344	1076.5715	(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	3793.7092	3738.4486	3445.4885	2932.0560	2281.4958	1530.0609	994.3996	1044.1459	1634.5816	2423.9944	3149.9386	3769.8518	(97)
Space heating kWh	1959.3994	1501.2934	1245.3791	722.2392	360.0182	0.0000	0.0000	0.0000	0.0000	773.0661	1409.3310	2003.8006	(98a)
Space heating requirement - total per year (kWh/year)												9974.5270	
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	1959.3994	1501.2934	1245.3791	722.2392	360.0182	0.0000	0.0000	0.0000	0.0000	773.0661	1409.3310	2003.8006	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9974.5270	
Space heating per m ²												(98c) / (4) =	42.3709 (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	2653.4989	2088.9247	2141.6033	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7782	0.8370	0.8013	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2064.8269	1748.4667	1716.0342	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3078.4262	2946.0640	2669.4576	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	729.7915	891.0124	709.3470	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4479	222.7531	177.3368	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												582.5377	(107)
Energy for space heating												42.3709	(99)
Energy for space cooling												2.4746	(108)
Total												44.8454	(109)
Fabric Energy Efficiency (TFEE)												44.8	(109)

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

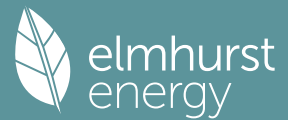
1. Overall dwelling characteristics

Area Storey height Volume

2. Ventilation rate

Page 13 of 27

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Assumed occupancy												3.0480 (42)
Hot water usage for mixer showers												
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)	
Hot water usage for baths												
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)	
Hot water usage for other uses												
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)	
Average daily hot water use (litres/day)												141.2695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)
Energy content	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Energy content (annual)												Total = Sum(45)m = 2346.4575
Distribution loss (46)m = 0.15 x (45)m												
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)	
Water storage loss (or HIU loss):												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.8400 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.5040 (55)
Total storage loss												
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (56)	
If cylinder contains dedicated solar storage												
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (57)	
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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												
290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924 (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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924 (64)
											Total per year (kWh/year) = Sum(64)m = 2866.2299 (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												
118.3577	105.0175	112.2470	100.0947	98.0313	83.2916	82.6014	85.4657	85.9586	101.4059	106.3131	117.2306 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
44.9622	39.9350	32.4773	24.5874	18.3794	15.5167	16.7663	21.7935	29.2512	37.1411	43.3491	46.2118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(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)												
-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)												
159.0829	156.2761	150.8696	139.0205	131.7625	115.6827	111.0234	114.8733	119.3870	136.2982	147.6570	157.5679	(72)
Total internal gains	926.6793	925.0957	896.4807	843.2101	787.4165	725.6920	695.7055	698.3322	726.0544	787.3871	847.2815	899.8371 (73)

6. Solar gains

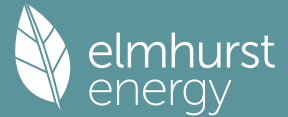
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.1100	10.6334		0.6300		0.7000		0.7700		23.1054 (74)
East				21.7500	19.6403		0.6300		0.7000		0.7700		130.5505 (76)
South				19.3500	46.7521		0.6300		0.7000		0.7700		276.4736 (78)
West				27.3600	19.6403		0.6300		0.7000		0.7700		164.2235 (80)
East				1.6900	26.6072		0.6300		0.7000		1.0000		17.8471 (82)
West				1.6900	26.6072		0.6300		0.7000		1.0000		17.8471 (82)
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541	(83)
Total gains	1556.7263	2070.8473	2622.6229	3191.7000	3568.8708	3542.6236	3389.1900	3067.4553	2671.2722	2099.7218	1615.9741	1429.4912	(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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097
util living area	0.9646	0.9302	0.8668	0.7563	0.6154	0.4699	0.3549	0.4023	0.6107	0.8381	0.9430	0.9710 (86)
MIT	18.8395	19.2052	19.7005	20.2228	20.5844	20.7781	20.8466	20.8316	20.6674	20.1269	19.3649	18.7670 (87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)
util rest of house	0.9589	0.9195	0.8472	0.7226	0.5653	0.4021	0.2728	0.3159	0.5418	0.8061	0.9324	0.9663 (89)
MIT 2	17.9165	18.2755	18.7541	19.2475	19.5668	19.7273	19.7728	19.7666	19.6493	19.1770	18.4434	17.8497 (90)
Living area fraction												fLA = Living area / (4) = 0.2269 (91)
MIT	18.1260	18.4865	18.9689	19.4688	19.7977	19.9658	20.0164	20.0082	19.8804	19.3925	18.6525	18.0578 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1260	18.4865	18.9689	19.4688	19.7977	19.9658	20.0164	20.0082	19.8804	19.3925	18.6525	18.0578 (93)

8. Space heating requirement

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9469	0.9027	0.8281	0.7081	0.5604	0.4061	0.2816	0.3244	0.5404	0.7888	0.9171	0.9558	(94)
Useful gains	1474.1034	1869.3194	2171.8401	2260.0274	2000.0567	1438.6450	954.2299	995.0428	1443.5664	1656.2499	1481.9720	1366.2927	(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	4045.8485	3969.3639	3637.1026	3059.9593	2341.2239	1541.2231	981.3112	1035.1413	1664.5144	2542.1100	3349.5482	4029.8468	(97)
Space heating kWh	1913.3784	1411.2300	1090.1553	575.9510	253.8284	0.0000	0.0000	0.0000	0.0000	659.0799	1344.6549	1981.6843	(98a)
Space heating requirement - total per year (kWh/year)												9229.9621	
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	1913.3784	1411.2300	1090.1553	575.9510	253.8284	0.0000	0.0000	0.0000	0.0000	659.0799	1344.6549	1981.6843	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9229.9621	
Space heating per m2											(98c) / (4) =	39.2080	(99)

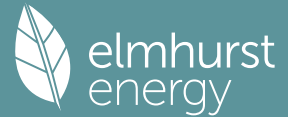
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													170.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1913.3784	1411.2300	1090.1553	575.9510	253.8284	0.0000	0.0000	0.0000	0.0000	659.0799	1344.6549	1981.6843	(98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)	
Space heating fuel (main heating system)	1125.5167	830.1353	641.2678	338.7947	149.3109	0.0000	0.0000	0.0000	0.0000	387.6941	790.9734	1165.6966	(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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924	(64)	
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)	
Fuel for water heating, kWh/month	170.6954	150.8396	159.8848	139.6341	134.7354	116.2293	113.9708	119.0382	120.9477	140.7055	150.6352	168.7014	(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	39.3551	31.5722	28.4272	20.8270	16.0874	13.1435	14.6754	19.0757	24.7774	32.5093	36.7192	40.4489	(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													5429.3894	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													170.0000	
Water heating fuel used													1686.0176	(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)													317.6186	(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													7433.0256	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5429.3894	16.4900	895.3063	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1686.0176	16.4900	278.0243	(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	317.6186	16.4900	52.3753	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1225.7059	(255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):

Energy cost factor (ECF)

SAP value

SAP rating (Section 12)

SAP band

$$\begin{aligned} & [(255) \times (256)] / [(4) + 45.0] = 0.3600 \quad (256) \\ & 1.5736 \quad (257) \\ & 74.4919 \\ & 74 \quad (258) \\ & C \end{aligned}$$

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	5429.3894	0.1556	844.7234 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1686.0176	0.1413	238.2392 (264)
Space and water heating			1082.9626 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	317.6186	0.1443	45.8422 (268)
Total CO ₂ , kg/year			1128.8048 (272)
CO ₂ emissions per m ²			4.8000 (273)
EI value			94.6058
EI rating			95 (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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

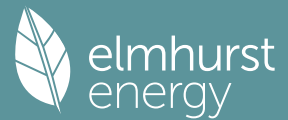
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2597 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2597 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.2856	0.2791	0.2791	0.2467	0.2467	0.2142	0.2142	0.2207	0.2207	0.2402	0.2467	0.2597 (22b)
Effective ac	0.5408	0.5390	0.5390	0.5304	0.5304	0.5229	0.5229	0.5244	0.5244	0.5288	0.5304	0.5337 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements A _{um} (A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)

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1ST LAND	148.6600	9.0000	1337.9400 (32c)
FF	113.4100	18.0000	2041.3800 (32d)
GF	113.4100	9.0000	1020.6900 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8404 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 169.8914 (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	119.6354	119.2299	119.2299	117.3420	117.3420	115.6872	115.6872	115.9995	115.9995	116.9924	117.3420	118.0692	(38)
Heat transfer coeff	289.5269	289.1213	289.1213	287.2335	287.2335	285.5787	285.5787	285.8910	285.8910	286.8839	287.2335	287.9606	(39)
Average = Sum(39)m / 12 =												287.2711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2299	1.2282	1.2282	1.2201	1.2201	1.2131	1.2131	1.2144	1.2144	1.2187	1.2201	1.2232	(40)
HLP (average)												1.2203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

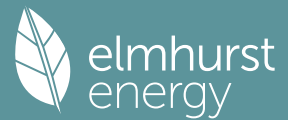
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers													
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)	
Hot water usage for baths													
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)	
Hot water usage for other uses													
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)	
Average daily hot water use (litres/day)													141.2695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)	
Energy content (annual)													
243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	2346.4575	
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)	
Water storage loss (or HIU loss):													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													0.8400 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.5040 (55)
Total storage loss													
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240	(56)	
If cylinder contains dedicated solar storage													
15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240	(57)	
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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													
290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924	(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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
118.3577	105.0175	112.2470	100.0947	98.0313	83.2916	82.6014	85.4657	85.9586	101.4059	106.3131	117.2306	(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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	44.9622	39.9350	32.4773	24.5874	18.3794	15.5167	16.7663	21.7935	29.2512	37.1411	43.3491	46.2118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)													
	159.0829	156.2761	150.8696	139.0205	131.7625	115.6827	111.0234	114.8733	119.3870	136.2982	147.6570	157.5679	(72)
Total internal gains													
	926.6793	925.0957	896.4807	843.2101	787.4165	725.6920	695.7055	698.3322	726.0544	787.3871	847.2815	899.8371	(73)

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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	
North	7.1100		12.0539		0.6300		0.7000		0.7700		26.1920 (74)	
East	21.7500		22.4175		0.6300		0.7000		0.7700		149.0108 (76)	
South	19.3500		51.7504		0.6300		0.7000		0.7700		306.0318 (78)	
West	27.3600		22.4175		0.6300		0.7000		0.7700		187.4453 (80)	
East	1.6900		30.5425		0.6300		0.7000		1.0000		20.4867 (82)	
West	1.6900		30.5425		0.6300		0.7000		1.0000		20.4867 (82)	
Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271	590.7272 (83)
Total gains	1636.3325	2128.2887	2678.5673	3313.9221	3642.2414	3757.7110	3563.4592	3232.9604	2821.5983	2227.6990	1734.4086	1490.5643 (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	24.2517	24.2857	24.2857	24.4454	24.4454	24.5870	24.5870	24.5602	24.5602	24.4752	24.4454	24.3836
alpha	2.6168	2.6190	2.6190	2.6297	2.6297	2.6391	2.6391	2.6373	2.6373	2.6317	2.6297	2.6256
util living area	0.9593	0.9238	0.8539	0.7265	0.5788	0.4048	0.2807	0.3076	0.5442	0.8027	0.9306	0.9672 (86)
MIT	18.9393	19.2879	19.7981	20.3216	20.6460	20.8191	20.8670	20.8627	20.7395	20.2613	19.4900	18.8559 (87)
Th 2	19.8962	19.8975	19.8975	19.9039	19.9039	19.9095	19.9095	19.9085	19.9085	19.9051	19.9039	19.9015 (88)
util rest of house	0.9528	0.9123	0.8325	0.6897	0.5255	0.3357	0.1988	0.2186	0.4692	0.7646	0.9179	0.9619 (89)
MIT 2	18.0226	18.3638	18.8541	19.3428	19.6233	19.7601	19.7884	19.7860	19.7093	19.3059	18.5719	17.9446 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2306	18.5735	19.0683	19.5649	19.8554	20.0004	20.0332	20.0303	19.9430	19.5227	18.7803	18.1514 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2306	18.5735	19.0683	19.5649	19.8554	20.0004	20.0332	20.0303	19.9430	19.5227	18.7803	18.1514 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9399	0.8951	0.8137	0.6772	0.5230	0.3417	0.2083	0.2288	0.4718	0.7493	0.9015	0.9506 (94)
Useful gains	1538.0167	1905.0109	2179.5500	2244.2121	1904.9166	1283.9279	742.1776	739.5916	1331.1362	1669.1456	1563.4943	1416.9625 (95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)
Heat loss rate W	3975.3873	3895.4756	3518.1261	2919.7068	2170.1628	1342.3311	751.9865	751.9770	1470.3498	2387.6470	3268.7950	3959.8727 (97)
Space heating kWh	1813.4037	1337.5923	995.9006	486.3562	197.3431	0.0000	0.0000	0.0000	0.0000	534.5651	1227.8165	1891.9252 (98a)
Space heating requirement - total per year (kWh/year)	8484.9027											
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	1813.4037	1337.5923	995.9006	486.3562	197.3431	0.0000	0.0000	0.0000	0.0000	534.5651	1227.8165	1891.9252 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8484.9027											
Space heating per m2	(98c) / (4) = 36.0431 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1813.4037	1337.5923	995.9006	486.3562	197.3431	0.0000	0.0000	0.0000	0.0000	534.5651	1227.8165	1891.9252 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	1066.7081	786.8190	585.8239	286.0919	116.0842	0.0000	0.0000	0.0000	0.0000	314.4501	722.2450	1112.8972 (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	290.1823	256.4274	271.8042	237.3780	229.0502	197.5898	193.7504	202.3649	205.6111	239.1994	256.0798	286.7924 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	170.6954	150.8396	159.8848	139.6341	134.7354	116.2293	113.9708	119.0382	120.9477	140.7055	150.6352	168.7014 (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	39.3551	31.5722	28.4272	20.8270	16.0874	13.1435	14.6754	19.0757	24.7774	32.5093	36.7192	40.4489 (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)												

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(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												4991.1192	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1686.0176	(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)												317.6186	(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												6994.7554	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4991.1192	28.4300	1418.9752	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1686.0176	28.4300	479.3348	(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	317.6186	28.4300	90.2990	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1988.6090	(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	4991.1192	0.1560	778.8562	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1686.0176	0.1413	238.2392	(264)
Space and water heating			1017.0954	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	317.6186	0.1443	45.8422	(268)
Total CO2, kg/year			1062.9376	(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	4991.1192	1.5777	7874.4562	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1686.0176	1.5225	2566.9801	(278)
Space and water heating			10441.4363	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	317.6186	1.5338	487.1739	(282)
Total Primary energy kWh/year			10928.6103	(286)

SAP 10 EPC IMPROVEMENTS

BE LEAN main dwelling

Current energy efficiency rating: C 74
Current environmental impact rating: A 95

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:			
N Solar water heating	SAP change + 1.1	Cost change -£ 104	CO2 change -46 kg (4.3%)
U Solar photovoltaic panels	+ 3.5	-£ 303	-144 kg (14.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£104	0.19 kg/m ²	C 76	A 95
Solar photovoltaic panels	£303	0.61 kg/m ²	C 79	A 95
Total Savings	£407	0.80 kg/m ²		

Potential energy efficiency rating: C 79
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

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Electricity	£1989	£1885	£104
Space heating	£1419	£1443	-£24
Water heating	£479	£352	£127
Lighting	£90	£90	£0
Generated (PV)	-£0	-£303	£303
Total cost of fuels	£1989	£1582	£407
Total cost of uses	£1988	£1582	£406
Delivered energy	30 kWh/m²	24 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	5 kg/m²	4 kg/m²	1 kg/m²
Primary energy	46 kWh/m²	37 kWh/m²	9 kWh/m²

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 (m²)	Storey height (m)	Volume (m³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (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) =	0.0597 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2597	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2597	(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	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (22b)
Effective ac	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (25)

3. Heat losses and heat loss parameter

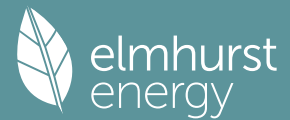
Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Main dwelling							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	152.0510	(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K		107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301

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E16 Corner (normal)													22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights													12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)													15.7000	0.0510	0.8007
R5 Ridge (inverted)													6.5920	0.0400	0.2637
R8 Roof to wall (rafter)													5.1650	0.0600	0.3099
R1 Head of roof window													4.7600	0.0410	0.1952
E14 Flat roof													7.4210	0.0700	0.5195
R2 Sill of roof window													4.7600	0.0370	0.1761
R3 Jamb of roof window													2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)													22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)													20.9000	-0.0200	-0.4180
Thermal bridges (Sum(L x Psi) calculated using Appendix K)															17.8404 (36)
Point Thermal Bridges															0.0000
Total fabric heat loss															(33) + (36) + (36a) = 169.8914 (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	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080	(38)		
Average = Sum(39)m / 12 =	292.6267	292.1559	291.6944	289.5269	289.1213	287.2335	287.2335	286.8839	287.9606	289.1213	289.9417	290.7994	(39)		
													289.5249		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353	(40)		
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31			

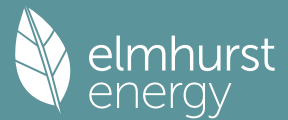
4. Water heating energy requirements (kWh/year)															

Assumed occupancy															3.0480 (42)
Hot water usage for mixer showers															
	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)		
Hot water usage for baths															
	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)		
Hot water usage for other uses															
	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)		
Average daily hot water use (litres/day)															141.2695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)		
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)		
Energy content (annual)													Total = Sum(45)m =		2346.4575
Distribution loss (46)m = 0.15 x (45)m															
	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)		
Water storage loss (or HIU loss):															
Store volume															200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):															0.8400 (48)
Temperature factor from Table 2b															0.6000 (49)
Enter (49) or (54) in (55)															0.5040 (55)
Total storage loss															
	15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240	(56)		
If cylinder contains dedicated solar storage															
	15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240	(57)		
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612	(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															
	290.1823	256.4274	269.9345	228.3312	211.9116	184.9831	180.7235	190.2685	200.2082	237.3298	256.0798	286.7924	(62)		
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)		
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)		
Aperture area of solar collector															3.0000 (H1)
Zero-loss collector efficiency															0.8000 (H2)
Collector linear heat loss coefficient															1.8000 (H3)
Collector 2nd order heat loss coefficient															0.0000 (H4)
Collector loop efficiency															0.9000 (H5)
Incidence angle modifier															1.0000 (H6)
Overshading factor															0.8000 (H8)
Overall heat loss coefficient of system															6.5000 (H10)
Heat loss coefficient of collector loop															3.9667 (H11)
Dedicated solar storage volume															75.0000 (H12)
Effective solar volume															75.0000 (H14)
Reference volume															225.0000 (H15)
Storage tank correction coefficient															1.3161 (H16)
Heat delivered to hot water															625.7786 (H24)
Heat delivered to space heating															0.0000 (H29)
Solar input															625.7786
Solar input	-0.0000	-16.1943	-58.7974	-81.0259	-105.8785	-96.9649	-96.1124	-84.0882	-57.9820	-28.7350	-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	290.1823	240.2330	211.1371	147.3053	106.0331	88.0182	84.6111	106.1803	142.2262	208.5948	256.0798	286.7924	(64)		
													Total per year (kWh/year) = Sum(64)m =		2167.3935 (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															
	118.3577	105.0175	110.7512	92.8573	84.3204	73.2062	72.1799	75.7886	81.6363	99.9102	106.3131	117.2306	(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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5															
	44.9622	39.9350	32.4773	24.5874	18.3794	15.5167	16.7663	21.7935	29.2512	37.1411	43.3491	46.2118	(67)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5															
	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5															
	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(69)		
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)		
Losses e.g. evaporation (negative values) (Table 5)															
	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)		
Water heating gains (Table 5)															
	159.0829	156.2761	148.8592	128.9685	113.3338	101.6753	97.0159	101.8664	113.3838	134.2878	147.6570	157.5679	(72)		
Total internal gains															
	926.6793	925.0957	894.4703	833.1581	768.9878	711.6846	681.6981	685.3253	720.0512	785.3767	847.2815	899.8371	(73)		

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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
North	7.1100	10.6334	0.6300	0.7000	0.7700	23.1054 (74)
East	21.7500	19.6403	0.6300	0.7000	0.7700	130.5505 (76)
South	19.3500	46.7521	0.6300	0.7000	0.7700	276.4736 (78)
West	27.3600	19.6403	0.6300	0.7000	0.7700	164.2235 (80)
East	1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)
West	1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)

Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541 (83)
Total gains	1556.7263	2070.8473	2620.6125	3181.6480	3550.4421	3528.6161	3375.1826	3054.4484	2665.2690	2097.7114	1615.9741	1429.4912 (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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097
util living area	0.9646	0.9302	0.8670	0.7574	0.6174	0.4714	0.3562	0.4037	0.6116	0.8383	0.9430	0.9710 (86)
MIT	18.8395	19.2052	19.6997	20.2203	20.5819	20.7772	20.8462	20.8311	20.6666	20.1262	19.3649	18.7670 (87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)
util rest of house	0.9589	0.9195	0.8474	0.7237	0.5673	0.4035	0.2739	0.3171	0.5427	0.8064	0.9324	0.9663 (89)
MIT 2	17.9165	18.2755	18.7534	19.2453	19.5649	19.7268	19.7726	19.7663	19.6488	19.1764	18.4434	17.8497 (90)
Living area fraction	18.1260	18.4865	18.9682	19.4666	19.7957	19.9652	20.0162	20.0080	19.8798	19.3919	18.6525	0.2269 (91)
MIT	18.1260	18.4865	18.9682	19.4666	19.7957	19.9652	20.0162	20.0080	19.8798	19.3919	18.6525	18.0578 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1260	18.4865	18.9682	19.4666	19.7957	19.9652	20.0162	20.0080	19.8798	19.3919	18.6525	18.0578 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9469	0.9027	0.8283	0.7092	0.5624	0.4074	0.2826	0.3256	0.5413	0.7891	0.9171	0.9558 (94)
Useful gains	1474.1034	1869.3194	2170.6924	2256.3629	1996.6614	1437.6821	953.9273	994.6007	1442.5783	1655.2529	1481.9720	1366.2927 (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	4045.8485	3969.3639	3636.8901	3059.3005	2340.6386	1541.0615	981.2587	1035.0652	1664.3434	2541.9269	3349.5482	4029.8468 (97)
Space heating kWh	1913.3784	1411.2300	1090.8511	578.1151	255.9190	0.0000	0.0000	0.0000	0.0000	659.6855	1344.6549	1981.6843 (98a)
Space heating requirement - total per year (kWh/year)												9235.5181
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	1913.3784	1411.2300	1090.8511	578.1151	255.9190	0.0000	0.0000	0.0000	0.0000	659.6855	1344.6549	1981.6843 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9235.5181
Space heating per m2										(98c) / (4) =		39.2316 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1913.3784	1411.2300	1090.8511	578.1151	255.9190	0.0000	0.0000	0.0000	0.0000	659.6855	1344.6549	1981.6843 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	1125.5167	830.1353	641.6771	340.0677	150.5406	0.0000	0.0000	0.0000	0.0000	388.0503	790.9734	1165.6966 (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	290.1823	240.2330	211.1371	147.3053	106.0331	88.0182	84.6111	106.1803	142.2262	208.5948	256.0798	286.7924 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	170.6954	141.3136	124.1983	86.6502	62.3724	51.7754	49.7712	62.4590	83.6625	122.7028	150.6352	168.7014 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	39.3551	31.5722	28.4272	20.8270	16.0874	13.1435	14.6754	19.0757	24.7774	32.5093	36.7192	40.4489 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-42.4984	-65.7304	-101.6310	-119.0415	-127.1879	-109.9052	-108.2363	-100.4203	-86.8219	-76.1407	-48.3892	-36.1055 (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)

elmhurst
energy

10a. Fuel costs - using Table 12 prices11a. SAP rating - Individual heating systems

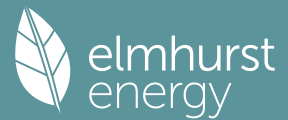
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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

Page 23 of 27

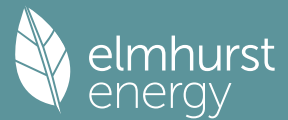
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2. Ventilation rate

										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)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										40.0000	Air changes per hour / (5) =	0.0597 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												4.0000 (17)
Infiltration rate												0.2597 (18)
Number of sides sheltered												0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.2597 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.2856	0.2791	0.2791	0.2467	0.2467	0.2142	0.2142	0.2207	0.2207	0.2402	0.2467	0.2597 (22b)
Effective ac	0.5408	0.5390	0.5390	0.5304	0.5304	0.5229	0.5229	0.5244	0.5244	0.5288	0.5304	0.5337 (25)

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Water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
Average daily hot water use (litres/day)												141.2695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)
Distribution loss (46)m = 0.15 x (45)m	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Water storage loss (or HIU loss):	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.8400 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.5040 (55)
Total storage loss	15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (56)
If cylinder contains dedicated solar storage	15.6240	14.1120	15.6240	15.1200	15.6240	15.1200	15.6240	15.6240	15.1200	15.6240	15.1200	15.6240 (57)
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612 (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	290.1823	256.4274	269.9345	228.3312	211.9116	184.9831	180.7235	190.2685	200.2082	237.3298	256.0798	286.7924 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												689.0219 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												689.0219
Solar input	-0.0000	-19.3769	-62.6413	-87.4742	-109.9353	-106.1038	-104.0969	-92.7185	-66.0145	-36.8373	-3.8231	-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	290.1823	237.0505	207.2932	140.8570	101.9763	78.8793	76.6266	97.5500	134.1937	200.4924	252.2567	286.7924 (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	118.3577	105.0175	110.7512	92.8573	84.3204	73.2062	72.1799	75.7886	81.6363	99.9102	106.3131	117.2306 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.9622	39.9350	32.4773	24.5874	18.3794	15.5167	16.7663	21.7935	29.2512	37.1411	43.3491	46.2118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	159.0829	156.2761	148.8592	128.9685	113.3338	101.6753	97.0159	101.8664	113.3838	134.2878	147.6570	157.5679 (72)
Total internal gains	926.6793	925.0957	894.4703	833.1581	768.9878	711.6846	681.6981	685.3253	720.0512	785.3767	847.2815	899.8371 (73)

6. Solar gains												

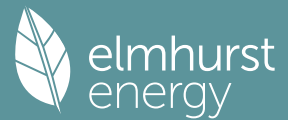
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	7.1100	12.0539	0.6300	0.7000	0.7700	26.1920 (74)						
East	21.7500	22.4175	0.6300	0.7000	0.7700	149.0108 (76)						
South	19.3500	51.7504	0.6300	0.7000	0.7700	306.0318 (78)						
West	27.3600	22.4175	0.6300	0.7000	0.7700	187.4453 (80)						
East	1.6900	30.5425	0.6300	0.7000	1.0000	20.4867 (82)						
West	1.6900	30.5425	0.6300	0.7000	1.0000	20.4867 (82)						

Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271	590.7272 (83)
Total gains	1636.3325	2128.2887	2676.5569	3303.8701	3623.8128	3743.7035	3549.4518	3219.9534	2815.5951	2225.6886	1734.4086	1490.5643 (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	24.2517	24.2857	24.2857	24.4454	24.4454	24.5870	24.5870	24.5602	24.5602	24.4752	24.4454	24.3836
alpha	2.6168	2.6190	2.6190	2.6297	2.6297	2.6391	2.6391	2.6373	2.6373	2.6317	2.6297	2.6256
util living area	0.9593	0.9238	0.8541	0.7275	0.5808	0.4061	0.2817	0.3087	0.5450	0.8030	0.9306	0.9672 (86)
MIT	18.9393	19.2879	19.7974	20.3193	20.6439	20.8186	20.8669	20.8625	20.7390	20.2607	19.4900	18.8559 (87)
Th 2	19.8962	19.8975	19.8975	19.9039	19.9039	19.9095	19.9095	19.9085	19.9085	19.9051	19.9039	19.9015 (88)
util rest of house												

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MIT 2	0.9528	0.9123	0.8327	0.6909	0.5275	0.3368	0.1995	0.2194	0.4700	0.7650	0.9179	0.9619 (89)
Living area fraction	18.0226	18.3638	18.8535	19.3409	19.6218	19.7598	19.7884	19.7859	19.7089	19.3054	18.5719	17.9446 (90)
MIT	18.2306	18.5735	19.0676	19.5629	19.8538	20.0001	20.0331	20.0302	fLA = Living area / (4) =			0.2269 (91)
Temperature adjustment									19.9427	19.5222	18.7803	18.1514 (92)
adjusted MIT	18.2306	18.5735	19.0676	19.5629	19.8538	20.0001	20.0331	20.0302	19.9427	19.5222	18.7803	18.1514 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9399	0.8951	0.8139	0.6783	0.5249	0.3428	0.2091	0.2296	0.4725	0.7496	0.9015	0.9506 (94)	
Useful gains	1538.0167	1905.0109	2178.4606	2241.0014	1902.1680	1283.3727	742.0654	739.4491	1330.4847	1668.2870	1563.4943	1416.9625 (95)	
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)	
Heat loss rate W	3975.3873	3895.4756	3517.9259	2919.1376	2169.6953	1342.2383	751.9660	751.9509	1470.2388	2387.4914	3268.7950	3959.8727 (97)	
Space heating kWh	1813.4037	1337.5923	996.5622	488.2581	199.0403	0.0000	0.0000	0.0000	0.0000	535.0880	1227.8165	1891.9252 (98a)	
Space heating requirement - total per year (kWh/year)												8489.6863	
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	1813.4037	1337.5923	996.5622	488.2581	199.0403	0.0000	0.0000	0.0000	0.0000	535.0880	1227.8165	1891.9252 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												8489.6863	
Space heating per m2												(98c) / (4) =	36.0634 (99)

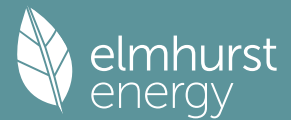
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1813.4037	1337.5923	996.5622	488.2581	199.0403	0.0000	0.0000	0.0000	0.0000	535.0880	1227.8165	1891.9252 (98)	
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)	
Space heating fuel (main heating system)	1066.7081	786.8190	586.2131	287.2106	117.0825	0.0000	0.0000	0.0000	0.0000	314.7577	722.2450	1112.8972 (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	290.1823	237.0505	207.2932	140.8570	101.9763	78.8793	76.6266	97.5500	134.1937	200.4924	252.2567	286.7924 (64)	
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)	
Fuel for water heating, kWh/month	170.6954	139.4415	121.9371	82.8571	59.9860	46.3996	45.0745	57.3823	78.9374	117.9367	148.3863	168.7014 (219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
(221)m	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)	
Pumps and Fa	39.3551	31.5722	28.4272	20.8270	16.0874	13.1435	14.6754	19.0757	24.7774	32.5093	36.7192	40.4489 (232)	
Lighting													
Electricity generated by PVs (Appendix M) (negative quantity)	-47.3573	-68.4948	-103.6897	-121.7863	-127.1648	-114.4540	-112.0391	-104.5234	-91.2634	-81.0569	-54.7880	-39.9324 (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												4993.9331 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												170.0000	
Water heating fuel used												1237.7355 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
pump for solar water heating												80.0000 (230g)	
Total electricity for the above, kWh/year												80.0000 (231)	
Electricity for lighting (calculated in Appendix L)												317.6186 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1066.5502 (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												5562.7370 (238)	

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
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Space heating - main system 1	4993.9331	28.4300	1419.7752 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1237.7355	28.4300	351.8882 (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)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	317.6186	28.4300	90.2990 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1066.5502	28.4300	-303.2202
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-303.2202 (252)
Total energy cost			1581.4861 (255)

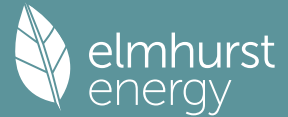
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4993.9331	0.1560	779.2493 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1237.7355	0.1463	181.1296 (264)
Space and water heating			960.3789 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	317.6186	0.1443	45.8422 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1066.5502	0.1346	-143.5614
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-143.5614 (269)
Total CO2, kg/year			873.7566 (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	4993.9331	1.5777	7878.7253 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1237.7355	1.5414	1907.7905 (278)
Space and water heating			9786.5159 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	317.6186	1.5338	487.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1066.5502	1.4975	-1597.1477
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1597.1477 (283)
Total Primary energy kWh/year			8797.5662 (286)

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Plot Reference	BASE/BELEAN/BEGREEN				Issued on Date	27/01/2026
Assessment Reference	BE LEAN annex dwelling	Plot Type Ref	Flint House			
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD				SAP Version	10.2
SAP Rating	75 C	DER	7.58	TER	13.02	
Environmental	95 A	% DER < TER				41.78
CO ₂ Emissions (t/year)	0.34	DFEE	47.22	TFEE	52.34	
Compliance Check	See BREL	% DFEE < TFEE				9.78
% DPER < TPER	-13.95	DPER	79.25	TPER	69.55	
Assessor Details	Mr. Neil Bradford				Assessor ID	T704-0001
Client	Flint House, Joe Reader					

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	48.9300 (1b)	3.1400 (2b)	153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402 (4)
Dwelling volume			153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1100	5.3823	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.5638		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)

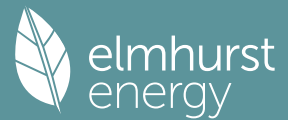
Heat capacity Cm = Sum (A x k) (28)...(30) + (32) + (32a)...(32e) = 7460.4000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 152.4709 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	5.7700	0.0620	0.3577
E2 Other lintels (including other steel lintels)	5.7700	0.0390	0.2250
E3 Sill	9.6400	0.0520	0.5013
E4 Jamb	22.8400	0.0750	1.7130
E5 Ground floor (normal)	6.2500	0.0360	0.2250
E16 Corner (normal)	6.2800	0.0990	0.6217
E18 Party wall between dwellings	5.7170	0.0800	0.4574
P1 Party wall - Ground floor			

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E11 Eaves (insulation at rafter level)	17.1400	0.0080	0.1371									
E13 Gable (insulation at rafter level)	6.4000	0.0510	0.3264									
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104									
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714									
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.1037 (36)
Point Thermal bridges												0.0000
Total fabric heat loss											(33) + (36) + (36a) =	38.6675 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Average = Sum(39)m / 12 =	69.1145	68.9166	68.7226	67.8115	67.6410	66.8475	66.8475	66.7005	67.1531	67.6410	67.9859	68.3464 (39)
												67.8107
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4125	1.4085	1.4045	1.3859	1.3824	1.3662	1.3662	1.3632	1.3724	1.3824	1.3895	1.3968 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

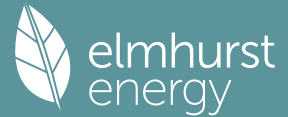
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.6586 (42)
Hot water usage for mixer showers												66.5147 (42a)
Hot water usage for baths												0.0000 (42b)
Hot water usage for other uses												31.6162 (42c)
Average daily hot water use (litres/day)												90.3022 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Distribution loss (46)m = 0.15 x (45)m												1500.0391
Water storage loss (or HIU loss):												23.0474 (46)
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss												18.6000 (56)
If cylinder contains dedicated solar storage												18.6000 (57)
Primary loss												31.1612 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												203.4104 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												203.4104 (64)
12Total per year (kWh/year)												2054.8515 (64)
Electric shower(s)												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												90.8973 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												108.0696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												31.2932 (69)
Pumps, fans												3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-66.3459 (71)
Water heating gains (Table 5)												122.1738 (72)
Total internal gains												384.2297 (73)

6. Solar gains												
[Jan]												
Area												
Solar flux												
Specific data												
Specific data												
Access factor												
Gains W												
South												98.4446 (78)
West												19.9277 (80)
Solar gains												101.4528 (83)
Total gains												485.6825 (84)

7. Mean internal temperature (heating season)

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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	29.9841	30.0702	30.1551	30.5602	30.6372	31.0009	31.0009	31.0692	30.8598	30.6372	30.4818	30.3210
alpha	2.9989	3.0047	3.0103	3.0373	3.0425	3.0667	3.0667	3.0713	3.0573	3.0425	3.0321	3.0214
util living area	0.9499	0.9210	0.8815	0.8102	0.7053	0.5626	0.4256	0.4543	0.6372	0.8248	0.9219	0.9557 (86)
MIT	19.4092	19.6575	19.9620	20.3257	20.6120	20.7984	20.8676	20.8598	20.7428	20.3785	19.8422	19.3724 (87)
Th 2	19.7537	19.7568	19.7599	19.7742	19.7768	19.7894	19.7894	19.7917	19.7845	19.7768	19.7714	19.7658 (88)
util rest of house	0.9400	0.9061	0.8588	0.7733	0.6471	0.4761	0.3173	0.3459	0.5549	0.7831	0.9044	0.9469 (89)
MIT 2	18.3430	18.5849	18.8786	19.2284	19.4815	19.6374	19.6788	19.6777	19.5964	19.2873	18.7803	18.3168 (90)
Living area fraction									fLA = Living area /	(4) =		0.6626 (91)
MIT	19.0494	19.2956	19.5964	19.9554	20.2306	20.4066	20.4665	20.4610	20.3560	20.0103	19.4839	19.0162 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0494	19.2956	19.5964	19.9554	20.2306	20.4066	20.4665	20.4610	20.3560	20.0103	19.4839	19.0162 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9332	0.8996	0.8554	0.7793	0.6699	0.5218	0.3792	0.4075	0.5956	0.7919	0.8997	0.9404 (94)
Useful gains	475.8857	539.1126	559.0570	542.7545	475.7336	354.9375	249.3054	259.2106	367.7828	452.1676	460.8792	456.7241 (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	1019.3991	992.0943	900.0197	749.6856	577.0153	388.1581	258.4646	270.8694	420.1076	636.5239	841.9275	1012.6338 (97)
Space heating kWh	404.3740	304.4038	253.6763	148.9904	75.3536	0.0000	0.0000	0.0000	0.0000	137.1611	274.3547	413.5968 (98a)
Space heating requirement - total per year (kWh/year)												2011.9107
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	404.3740	304.4038	253.6763	148.9904	75.3536	0.0000	0.0000	0.0000	0.0000	137.1611	274.3547	413.5968 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2011.9107
Space heating per m2										(98c) / (4) =		41.1181 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	404.3740	304.4038	253.6763	148.9904	75.3536	0.0000	0.0000	0.0000	0.0000	137.1611	274.3547	413.5968 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	237.8670	179.0610	149.2213	87.6414	44.3257	0.0000	0.0000	0.0000	0.0000	80.6830	161.3851	243.2922 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532 (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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1183.4769 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1208.7362 (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)												114.0548 (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												

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Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2506.2679 (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	1183.4769	0.1552	183.6353	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1208.7362	0.1412	170.6246	(264)
Space and water heating			354.2600	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	114.0548	0.1443	16.4616	(268)
Total CO2, kg/year			370.7216	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5800	(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	1183.4769	1.5744	1863.3159	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1208.7362	1.5220	1839.6663	(278)
Space and water heating			3702.9823	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	114.0548	1.5338	174.9411	(282)
Total Primary energy kWh/year			3877.9234	(286)
Dwelling Primary energy Rate (DPER)			79.2500	(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	48.9300	3.1400	153.6402	(1b) - (3b)
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300			
Dwelling volume			153.6402	(5)

2. Ventilation rate

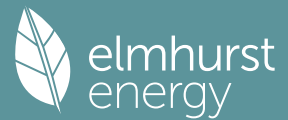
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3802	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3517 (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
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
Adj infilt rate	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854

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 Opening Type			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609		(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502		(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544		(30)
Total net area of external elements Aum(A, m2)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.1563	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4709 (35)

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List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0500	0.2885
E3 Sill	5.7700	0.0500	0.2885
E4 Jamb	9.6400	0.0500	0.4820
E5 Ground floor (normal)	22.8400	0.1600	3.6544
E16 Corner (normal)	6.2500	0.0900	0.5625
E18 Party wall between dwellings	6.2800	0.0600	0.3768
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
E11 Eaves (insulation at rafter level)	17.1400	0.0400	0.6856
E13 Gable (insulation at rafter level)	6.4000	0.0800	0.5120
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.0800	0.5120
R4 Ridge (vaulted ceiling)	8.5700	0.0800	0.6856
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.5053 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	43.6616 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Heat transfer coeff	74.1086	73.9107	73.7167	72.8056	72.6351	71.8416	71.8416	71.6946	72.1472	72.6351	72.9800	73.3405	(39)
Average = Sum(39)m / 12 =												72.8048	
HLP	1.5146	1.5105	1.5066	1.4880	1.4845	1.4683	1.4683	1.4652	1.4745	1.4845	1.4915	1.4989	(40)
HLP (average)												1.4879	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586 (42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)
Average daily hot water use (litres/day)												90.3022	(43)
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	(44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)
Water storage loss (or HIU loss):													
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													0.9749 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5264 (55)
Total storage loss	16.3190	14.7398	16.3190	15.7926	16.3190	15.7926	16.3190	16.3190	15.7926	16.3190	15.7926	16.3190	(56)
If cylinder contains dedicated solar storage	16.3190	14.7398	16.3190	15.7926	16.3190	15.7926	16.3190	16.3190	15.7926	16.3190	15.7926	16.3190	(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	195.4019	172.7863	183.4745	161.0643	155.9733	140.3726	138.3897	143.9626	145.6343	162.6093	173.1790	193.2306	(62)
WWHRS	-30.5247	-26.9963	-28.2689	-23.4078	-21.8152	-18.6674	-17.4978	-18.6071	-19.3141	-22.7692	-25.7947	-29.9594	(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	164.8772	145.7900	155.2055	137.6565	134.1581	121.7052	120.8919	125.3555	126.3202	139.8401	147.3843	163.2712	(64)
Total per year (kWh/year)												1682.4558	(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	83.4754	74.1650	79.5096	71.4613	70.3654	64.5813	64.5189	66.3719	66.3308	72.5719	75.4894	82.7535	(65)

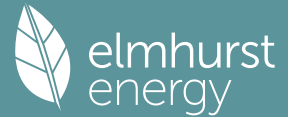
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)	112.1982	110.3646	106.8677	99.2518	94.5772	89.6962	86.7189	89.2095	92.1261	97.5429	104.8464	111.2278	(72)
Total internal gains	380.6278	388.1248	373.0189	359.7978	342.5356	327.5505	315.7629	316.7545	325.8850	339.9070	359.7981	373.2837	(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
South	6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)
West	3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)

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Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	499.0001	588.3345	642.5925	685.5462	699.1644	677.7929	655.0320	633.6896	615.0891	560.0617	501.3360	474.7365 (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	27.9635	28.0384	28.1121	28.4639	28.5307	28.8459	28.8459	28.9050	28.7237	28.5307	28.3959	28.2563
alpha	2.8642	2.8692	2.8741	2.8976	2.9020	2.9231	2.9231	2.9270	2.9149	2.9020	2.8931	2.8838
util living area	0.9544	0.9283	0.8927	0.8281	0.7308	0.5886	0.4511	0.4805	0.6614	0.8425	0.9296	0.9597 (86)
MIT	18.7994	19.1374	19.5658	20.0887	20.5209	20.8222	20.9397	20.9259	20.7345	20.1744	19.4063	18.7472 (87)
Th 2	19.6766	19.6796	19.6826	19.6965	19.6992	19.7114	19.7114	19.7137	19.7067	19.6992	19.6939	19.6883 (88)
util rest of house	0.9449	0.9140	0.8708	0.7919	0.6715	0.4963	0.3314	0.3613	0.5753	0.8017	0.9131	0.9513 (89)
MIT 2	17.1991	17.6206	18.1509	18.7888	19.2824	19.5957	19.6872	19.6814	19.5171	18.9075	17.9733	17.1409 (90)
Living area fraction	18.2594	18.6256	19.0884	19.6501	20.1030	20.4084	20.5171	20.5060	20.3237	19.7469	18.9228	18.2052 (91)
MIT	18.2594	18.6256	19.0884	19.6501	20.1030	20.4084	20.5171	20.5060	20.3237	19.7469	18.9228	18.2052 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2594	18.6256	19.0884	19.6501	20.1030	20.4084	20.5171	20.5060	20.3237	19.7469	18.9228	18.2052 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9318	0.8998	0.8591	0.7904	0.6913	0.5483	0.4081	0.4368	0.6188	0.8034	0.9009	0.9389 (94)
Useful gains	464.9609	529.4124	552.0678	541.8723	483.3131	371.6259	267.3155	276.8003	380.6290	449.9547	451.6718	445.7135 (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	1034.5143	1014.4689	927.9720	782.6677	610.3539	417.2819	281.4102	294.3776	449.0238	664.3886	862.8255	1027.1479 (97)
Space heating kWh	423.7477	325.9580	279.6727	173.3727	94.5184	0.0000	0.0000	0.0000	0.0000	159.5388	296.0306	432.5872 (98a)
Space heating requirement - total per year (kWh/year)												2185.4261
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	423.7477	325.9580	279.6727	173.3727	94.5184	0.0000	0.0000	0.0000	0.0000	159.5388	296.0306	432.5872 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2185.4261
Space heating per m2										(98c) / (4) =		44.6643 (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	423.7477	325.9580	279.6727	173.3727	94.5184	0.0000	0.0000	0.0000	0.0000	159.5388	296.0306	432.5872 (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)	459.0983	353.1505	303.0041	187.8361	102.4034	0.0000	0.0000	0.0000	0.0000	172.8481	320.7266	468.6752 (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	164.8772	145.7900	155.2055	137.6565	134.1581	121.7052	120.8919	125.3555	126.3202	139.8401	147.3843	163.2712 (64)
Efficiency of water heater (217)m	86.0806	85.8092	85.3640	84.5782	83.2891	79.8000	79.8000	79.8000	79.8000	84.3561	85.5914	79.8000 (216)
Fuel for water heating, kWh/month	191.5381	169.9003	181.8162	162.7565	161.0752	152.5128	151.4936	157.0871	158.2960	165.7736	172.1951	189.5460 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.9228	-51.7219	-70.1836	-74.4450	-76.8261	-70.6354	-69.8455	-67.6130	-63.1812	-57.0318	-41.6971	-34.0444 (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	-32.7203	-67.2292	-130.7421	-192.3228	-250.4835	-250.2149	-247.1665	-210.8858	-156.8367	-94.5864	-43.1650	-25.9868 (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												2367.7423 (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												2013.9904 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	122.5729 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2418.4879 (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	2171.8178 (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	2367.7423	0.2100	497.2259 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2013.9904	0.2100	422.9380 (264)
Space and water heating			920.1639 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	122.5729	0.1443	17.6911 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-716.1479	0.1358	-97.2564
PV Unit electricity exported	-1702.3399	0.1265	-215.3981
Total			-312.6545 (269)
Total CO2, kg/year			637.1297 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.0200 (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	2367.7423	1.1300	2675.5488 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2013.9904	1.1300	2275.8092 (278)
Space and water heating			4951.3580 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	122.5729	1.5338	188.0065 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-716.1479	1.5020	-1075.6383
PV Unit electricity exported	-1702.3399	0.4645	-790.7087
Total			-1866.3470 (283)
Total Primary energy kWh/year			3403.1183 (286)
Target Primary Energy Rate (TPER)			69.5500 (287)

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

1. Overall dwelling characteristics

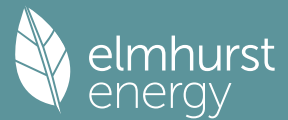
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (5)

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	2 * 10 = 20.0000 (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) = 20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												

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0.4484 0.4396 0.4308 0.3868 0.3780 0.3341 0.3341 0.3253 0.3517 0.3780 0.3956 0.4132 (22b)
 If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)
 If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23b)
 Effective ac 0.6005 0.5966 0.5928 0.5748 0.5715 0.5558 0.5558 0.5529 0.5618 0.5715 0.5783 0.5854 (23c)
 0.0000 (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								
Windows			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1100	5.3823	110.0000	5382.3000	(28a)
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200	(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	33.5638			(33)
Main dwelling								
GF			53.0800			9.0000	477.7200	(32e)

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

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577
E3 Sill	5.7700	0.0390	0.2250
E4 Jamb	9.6400	0.0520	0.5013
E5 Ground floor (normal)	22.8400	0.0750	1.7130
E16 Corner (normal)	6.2500	0.0360	0.2250
E18 Party wall between dwellings	6.2800	0.0990	0.6217
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
E11 Eaves (insulation at rafter level)	17.1400	0.0080	0.1371
E13 Gable (insulation at rafter level)	6.4000	0.0510	0.3264
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714

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

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 30.4470 30.2491 30.0551 29.1440 28.9735 28.1800 28.1800 28.0330 28.4856 28.9735 29.3184 29.6789 (38)
 Average = Sum(39)m / 12 = 69.1145 68.9166 68.7226 67.8115 67.6410 66.8475 66.8475 66.7005 67.1531 67.6410 67.9859 68.3464 (39)
 67.8107

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4125	1.4085	1.4045	1.3859	1.3824	1.3662	1.3662	1.3632	1.3724	1.3824	1.3895	1.3968 (40)
HLP (average)												1.3859
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6586 (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 22.4976 22.1635 21.6930 20.8255 20.1759 19.4555 19.0665 19.5337 20.0424 20.8132 21.6986 22.4216 (42b)
 Hot water usage for other uses 31.6162 30.4665 29.3168 28.1672 27.0175 25.8678 25.8678 27.0175 28.1672 29.3168 30.4665 31.6162 (42c)
 Average daily hot water use (litres/day) 49.6009 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378 (44)
Energy conte	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101 (45)
Energy content (annual)										Total = Sum(45)m =		823.7641
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):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		700.1995 (64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670 (64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964 (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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (69)

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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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672 (72)
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231 (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
South					6.8900	46.7521	0.6300	0.7000			0.7700			98.4446 (78)
West					3.3200	19.6403	0.6300	0.7000			0.7700			19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379			101.4528 (83)
Total gains	422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356			398.6759 (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	29.9841	30.0702	30.1551	30.5602	30.6372	31.0009	31.0009	31.0692	30.8598	30.6372	30.4818	30.3210
alpha	2.9989	3.0047	3.0103	3.0373	3.0425	3.0667	3.0667	3.0713	3.0573	3.0425	3.0321	3.0214
util living area	0.9683	0.9447	0.9113	0.8476	0.7503	0.6037	0.4625	0.4950	0.6827	0.8672	0.9480	0.9729 (86)
MIT	18.7917	19.1450	19.5804	20.1113	20.5399	20.8352	20.9459	20.9322	20.7452	20.1752	19.3965	18.7384 (87)
Th 2	19.7537	19.7568	19.7599	19.7742	19.7768	19.7894	19.7894	19.7917	19.7845	19.7768	19.7714	19.7658 (88)
util rest of house	0.9617	0.9334	0.8929	0.8151	0.6948	0.5153	0.3473	0.3800	0.6011	0.8318	0.9354	0.9671 (89)
MIT 2	17.7923	18.1389	18.5622	19.0736	19.4588	19.7034	19.7716	19.7676	19.6385	19.1470	18.4008	17.7483 (90)
Living area fraction	18.4545	18.8055	19.2368	19.7612	20.1751	20.4533	20.5497	20.5392	20.3718	19.8282	19.0606	18.4043 (92)
MIT	18.4545	18.8055	19.2368	19.7612	20.1751	20.4533	20.5497	20.5392	20.3718	19.8282	19.0606	18.4043 (93)
Temperature adjustment	18.4545	18.8055	19.2368	19.7612	20.1751	20.4533	20.5497	20.5392	20.3718	19.8282	19.0606	18.4043 (93)
adjusted MIT	18.4545	18.8055	19.2368	19.7612	20.1751	20.4533	20.5497	20.5392	20.3718	19.8282	19.0606	18.4043 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9526	0.9228	0.8837	0.8147	0.7142	0.5657	0.4214	0.4531	0.6428	0.8335	0.9264	0.9588 (94)
Ext temp.	402.2655	472.8969	502.6031	502.2746	452.0585	349.3584	251.5042	260.1561	356.0790	410.5548	397.6287	382.2527 (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	978.2818	958.3211	875.3062	736.5135	573.2634	391.2773	264.0264	276.0887	421.1681	624.2067	813.1490	970.8131 (97)
Space heating requirement - total per year (kWh/year)	428.5561	326.2050	277.2911	168.6520	90.1765	0.0000	0.0000	0.0000	0.0000	158.9570	299.1746	437.8889 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	428.5561	326.2050	277.2911	168.6520	90.1765	0.0000	0.0000	0.0000	0.0000	158.9570	299.1746	437.8889 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98d)
Space heating per m2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98e)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7911	0.8557	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	497.1169	423.2821	424.7662	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	695.8664	673.1160	647.9768	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	143.0996	185.8764	166.0687	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	0.0000	0.0000	0.0000	0.0000	35.7749	46.4691	41.5172	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (108)
Energy for space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (109)
Total	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (110)
Fabric Energy Efficiency (DFEE)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (111)

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1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.9300	3.1400	153.6402
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(1b) - (3b)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	153.6402 (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	2 * 10 = 20.0000 (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 20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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
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
Adj infilt rate	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854

3. Heat losses and heat loss parameter

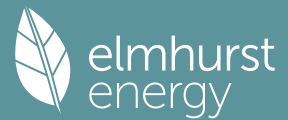
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Opening Type			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609		(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502		(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544		(30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.1563	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.4709 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0500	0.2885	
E3 Sill				5.7700	0.0500	0.2885	
E4 Jamb				9.6400	0.0500	0.4820	
E5 Ground floor (normal)				22.8400	0.1600	3.6544	
E16 Corner (normal)				6.2500	0.0900	0.5625	
E18 Party wall between dwellings				6.2800	0.0600	0.3768	
P1 Party wall - Ground floor				5.7170	0.0800	0.4574	
E11 Eaves (insulation at rafter level)				17.1400	0.0400	0.6856	
E13 Gable (insulation at rafter level)				6.4000	0.0800	0.5120	
P5 Party wall - Roof (insulation at rafter level)				6.4000	0.0800	0.5120	
R4 Ridge (vaulted ceiling)				8.5700	0.0800	0.6856	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5053 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 43.6616 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789
Average = Sum(39)m / 12 =	74.1086	73.9107	73.7167	72.8056	72.6351	71.8416	71.8416	71.6946	72.1472	72.6351	72.9800	73.3405
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5146	1.5105	1.5066	1.4880	1.4845	1.4683	1.4683	1.4652	1.4745	1.4845	1.4915	1.4989
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6586 (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	22.4976	22.1635	21.6930	20.8255	20.1759	19.4555	19.0665	19.5337	20.0424	20.8132	21.6986	22.4216 (42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												49.6009 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378 (44)
Energy content (annual)	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101 (45)
	Total = Sum(45)m =											823.7641

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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):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (64)
12Total per year (kWh/year)												700.1995 (64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												473.9595 (64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964 (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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672 (72)
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231 (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
South					6.8900	46.7521	0.6300	0.7000			0.7700	98.4446 (78)
West					3.3200	19.6403	0.6300	0.7000			0.7700	19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356	398.6759 (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	27.9635	28.0384	28.1121	28.4639	28.5307	28.8459	28.8459	28.9050	28.7237	28.5307	28.3959	28.2563
alpha	2.8642	2.8692	2.8741	2.8976	2.9020	2.9231	2.9231	2.9270	2.9149	2.9020	2.8931	2.8838
util living area	0.9692	0.9472	0.9164	0.8579	0.7674	0.6274	0.4872	0.5200	0.7036	0.8760	0.9503	0.9735 (86)
MIT	18.6059	18.9617	19.4140	19.9761	20.4475	20.7886	20.9261	20.9086	20.6846	20.0570	19.2373	18.5514 (87)
Th 2	19.6766	19.6796	19.6826	19.6965	19.6992	19.7114	19.7114	19.7137	19.7067	19.6992	19.6939	19.6883 (88)
util rest of house	0.9625	0.9361	0.8983	0.8257	0.7111	0.5340	0.3609	0.3948	0.6189	0.8410	0.9379	0.9678 (89)
MIT 2	17.5578	17.9071	18.3479	18.8908	19.3180	19.6020	19.6877	19.6819	19.5268	18.9810	18.1927	17.5121 (90)
Living area fraction									FLA = Living area / (4) =			0.6626 (91)
MIT	18.2523	18.6059	19.0543	19.6099	20.0664	20.3882	20.5083	20.4947	20.2939	19.6940	18.8848	18.2007 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2523	18.6059	19.0543	19.6099	20.0664	20.3882	20.5083	20.4947	20.2939	19.6940	18.8848	18.2007 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	402.4406	473.8746	504.9741	507.5504	461.0453	361.5950	263.4754	271.8740	365.6597	414.1628	398.3832	382.3272 (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	1033.9829	1013.0108	925.4615	779.7383	607.6937	415.8356	280.7755	293.5685	446.8726	660.5414	860.0552	1026.8210 (97)
Space heating kWh	469.8675	362.2995	312.8426	195.9753	109.1064	0.0000	0.0000	0.0000	0.0000	183.3056	332.4038	479.5034 (98a)
Space heating requirement - total per year (kWh/year)												2445.3040
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	469.8675	362.2995	312.8426	195.9753	109.1064	0.0000	0.0000	0.0000	0.0000	183.3056	332.4038	479.5034 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2445.3040
Space heating per m ²										(98c) / (4) =		49.9756 (99)

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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	675.3108	531.6276	544.8791	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7562	0.8253	0.8059	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	510.6415	438.7716	439.1261	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	133.3619	174.3523	155.3849	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	33.3405	43.5881	38.8462	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												115.7748 (107)
Energy for space cooling												49.9756 (99)
Total												2.3661 (108)
Fabric Energy Efficiency (TFEE)												52.3417 (109)
												52.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	48.9300 (1b)	3.1400 (2b)	153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6402 (5)

2. Ventilation rate

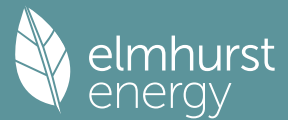
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1100	5.3823	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.5638		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7460.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.4709 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0620	0.3577	
E3 Sill				5.7700	0.0390	0.2250	
E4 Jamb				9.6400	0.0520	0.5013	
E5 Ground floor (normal)				22.8400	0.0750	1.7130	
E16 Corner (normal)				6.2500	0.0360	0.2250	
E18 Party wall between dwellings				6.2800	0.0990	0.6217	
P1 Party wall - Ground floor				5.7170	0.0800	0.4574	

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E11 Eaves (insulation at rafter level)						17.1400	0.0080	0.1371				
E13 Gable (insulation at rafter level)						6.4000	0.0510	0.3264				
P5 Party wall - Roof (insulation at rafter level)						6.4000	0.1110	0.7104				
R4 Ridge (vaulted ceiling)						8.5700	-0.0200	-0.1714				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											5.1037	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	38.6675 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Average = Sum(39)m / 12 =	69.1145	68.9166	68.7226	67.8115	67.6410	66.8475	66.8475	66.7005	67.1531	67.6410	67.9859	68.3464 (39)
												67.8107
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4125	1.4085	1.4045	1.3859	1.3824	1.3662	1.3662	1.3632	1.3724	1.3824	1.3895	1.3968 (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												1.6586 (42)
Hot water usage for mixer showers												
	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147 (42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												90.3022 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss												
	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage												
	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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												
	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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												
	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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												
	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973 (65)

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

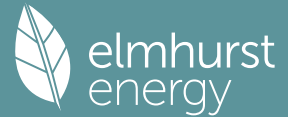
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)												
	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains												
	437.6781	436.2766	424.4638	402.0122	379.9573	348.3152	336.2736	338.3321	349.5646	381.3105	405.9942	427.6434 (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					
South			6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)				
West			3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)				
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	556.0504	636.4863	694.0374	727.7605	736.5862	698.5576	675.5427	655.2672	638.7687	601.4651	547.5321	529.0962 (84)

7. Mean internal temperature (heating season)

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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	29.9841	30.0702	30.1551	30.5602	30.6372	31.0009	31.0009	31.0692	30.8598	30.6372	30.4818	30.3210	
alpha	2.9989	3.0047	3.0103	3.0373	3.0425	3.0667	3.0667	3.0713	3.0573	3.0425	3.0321	3.0214	
util living area	0.9387	0.9100	0.8666	0.7954	0.6905	0.5514	0.4155	0.4429	0.6229	0.8081	0.9096	0.9457 (86)	
MIT	19.4926	19.7181	20.0184	20.3584	20.6293	20.8039	20.8697	20.8626	20.7526	20.4123	19.8998	19.4531 (87)	
Th 2	19.7537	19.7568	19.7599	19.7742	19.7768	19.7894	19.7894	19.7917	19.7845	19.7768	19.7714	19.7658 (88)	
util rest of house	0.9269	0.8934	0.8419	0.7572	0.6316	0.4656	0.3093	0.3365	0.5407	0.7644	0.8901	0.9352 (89)	
MIT 2	18.4233	18.6420	18.9300	19.2563	19.4944	19.6405	19.6795	19.6788	19.6025	19.3155	18.8340	18.3946 (90)	
Living area fraction									fLA = Living area / (4) =				0.6626 (91)
MIT	19.1318	19.3550	19.6511	19.9865	20.2464	20.4113	20.4681	20.4631	20.3645	20.0422	19.5402	19.0960 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1318	19.3550	19.6511	19.9865	20.2464	20.4113	20.4681	20.4631	20.3645	20.0422	19.5402	19.0960 (93)	

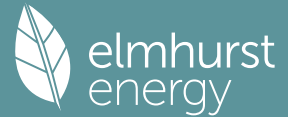
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9200	0.8873	0.8395	0.7644	0.6554	0.5111	0.3701	0.3970	0.5818	0.7747	0.8859	0.9284 (94)
Useful gains	511.5613	564.7383	582.6732	556.2972	482.7838	357.0675	250.0048	260.1568	371.6125	465.9774	485.0518	491.1964 (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	1025.0924	996.1893	903.7785	751.7938	578.0846	388.4732	258.5716	271.0128	420.6815	638.6793	845.7563	1018.0853 (97)
Space heating kWh	382.0671	289.9351	238.9023	140.7576	70.9038	0.0000	0.0000	0.0000	0.0000	128.4902	259.7072	392.0053 (98a)
Space heating requirement - total per year (kWh/year)												1902.7687
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	382.0671	289.9351	238.9023	140.7576	70.9038	0.0000	0.0000	0.0000	0.0000	128.4902	259.7072	392.0053 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1902.7687
Space heating per m2										(98c) / (4) =		38.8876 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	382.0671	289.9351	238.9023	140.7576	70.9038	0.0000	0.0000	0.0000	0.0000	128.4902	259.7072	392.0053	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	224.7454	170.5501	140.5308	82.7986	41.7081	0.0000	0.0000	0.0000	0.0000	75.5825	152.7689	230.5914	(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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532	(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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250	(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												1119.2757	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1208.7362	(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)												114.0548	(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)

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Energy used 0.0000 (237)
Total delivered energy for all uses 2442.0667 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1119.2757	16.4900	184.5686 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1208.7362	16.4900	199.3206 (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	114.0548	16.4900	18.8076 (250)
Additional standing charges			0.0000 (251)
Total energy cost			402.6968 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.5434 (257)
SAP value 74.9816
SAP rating (Section 12) 75 (258)
SAP band C

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	1119.2757	0.1552	173.7021 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1208.7362	0.1412	170.6246 (264)
Space and water heating			344.3267 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	114.0548	0.1443	16.4616 (268)
Total CO2, kg/year			360.7884 (272)
CO2 emissions per m2			7.3700 (273)
EI value			94.8530
EI rating			95 (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

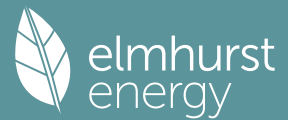
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6402 (5)
Dwelling volume			

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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)
Wind speed	Jan 4.4000 Feb 4.3000 Mar 4.3000 Apr 3.8000 May 3.8000 Jun 3.3000 Jul 3.3000 Aug 3.4000 Sep 3.4000 Oct 3.7000 Nov 3.8000 Dec 4.0000 (22)
Wind factor	1.1000 1.0750 1.0750 0.9500 0.9500 0.8250 0.8250 0.8500 0.8500 0.9250 0.9500 1.0000 (22a)
Adj infilt rate	0.3868 0.3780 0.3780 0.3341 0.3341 0.2901 0.2901 0.2989 0.2989 0.3253 0.3341 0.3517 (22b)
Effective ac	0.5748 0.5715 0.5715 0.5558 0.5558 0.5421 0.5421 0.5447 0.5447 0.5529 0.5558 0.5618 (25)

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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						
Windows			10.2100	1.1450	11.6908			(27)					
GF			48.9300	0.1100	5.3823	110.0000	5382.3000	(28a)					
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200	(29a)					
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)					
Total net area of external elements Aum(A, m2)			175.5700					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.5638			(33)					
Main dwelling													
GF			53.0800			9.0000	477.7200	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7460.4000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4709	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				5.7700	0.0620	0.3577							
E3 Sill				5.7700	0.0390	0.2250							
E4 Jamb				9.6400	0.0520	0.5013							
E5 Ground floor (normal)				22.8400	0.0750	1.7130							
E16 Corner (normal)				6.2500	0.0360	0.2250							
E18 Party wall between dwellings				6.2800	0.0990	0.6217							
P1 Party wall - Ground floor				5.7170	0.0800	0.4574							
E11 Eaves (insulation at rafter level)				17.1400	0.0080	0.1371							
E13 Gable (insulation at rafter level)				6.4000	0.0510	0.3264							
P5 Party wall - Roof (insulation at rafter level)				6.4000	0.1110	0.7104							
R4 Ridge (vaulted ceiling)				8.5700	-0.0200	-0.1714							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1037	(36)					
Point Thermal Bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	38.6675	(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	29.1440	28.9735	28.9735	28.1800	28.1800	27.4844	27.4844	27.6157	27.6157	28.0330	28.1800	28.4856	(38)
Average = Sum(39)m / 12 =	67.8115	67.6410	67.6410	66.8475	66.8475	66.1519	66.1519	66.2832	66.2832	66.7005	66.8475	67.1531	(39)
												66.8633	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3859	1.3824	1.3824	1.3662	1.3662	1.3520	1.3520	1.3547	1.3547	1.3632	1.3662	1.3724	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.3665	
												31	

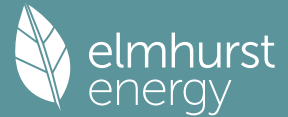
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586	(42)
Hot water usage for mixer showers														
66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	66.5147	(42a)	
Hot water usage for baths														
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	(42b)	
Hot water usage for other uses														
31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	31.6162	(42c)	
Average daily hot water use (litres/day)													90.3022	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	98.1309	(44)	
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1500.0391		
23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	23.0474	(46)	
Water storage loss (or HIU loss):														
Store volume													80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.6000	(55)
Total storage loss														
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.6000	18.6000	18.6000	18.6000	18.6000	(56)	
If cylinder contains dedicated solar storage														
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.6000	18.6000	18.6000	18.6000	18.6000	(57)	
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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														
205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	203.4104	(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														
205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	203.4104	(64)	
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month														
91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973	90.8973	(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	
99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944	16.5944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918	206.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)													

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Total internal gains	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
	437.6781	436.2766	424.4638	402.0122	379.9573	348.3152	336.2736	338.3321	349.5646	381.3105	405.9942	427.6434 (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
South				6.8900	51.7504		0.6300		0.7000		0.7700		108.9694 (78)
West				3.3200	22.4175		0.6300		0.7000		0.7700		22.7456 (80)
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889		111.8388 (83)
Total gains	569.3931	643.6585	698.7128	740.1836	742.1541	721.9457	694.0213	673.2797	656.6430	619.5047	567.2831		539.4823 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	30.5602	30.6372	30.6372	31.0009	31.0009	31.3269	31.3269	31.2649	31.2649	31.0692	31.0009	30.8598
util living area	3.0373	3.0425	3.0425	3.0667	3.0667	3.0885	3.0885	3.0843	3.0843	3.0713	3.0667	3.0573
MIT	0.9325	0.9037	0.8550	0.7714	0.6560	0.4862	0.3348	0.3449	0.5611	0.7742	0.8962	0.9408 (86)
Th 2	19.5837	19.7935	20.1013	20.4402	20.6869	20.8417	20.8874	20.8860	20.8046	20.5085	19.9991	19.5367 (87)
util rest of house	19.7742	19.7768	19.7768	19.7894	19.7894	19.8003	19.8003	19.7983	19.7983	19.7917	19.7894	19.7845 (88)
MIT 2	0.9197	0.8862	0.8285	0.7296	0.5924	0.3962	0.2269	0.2340	0.4723	0.7242	0.8743	0.9294 (89)
Living area fraction	18.5275	18.7303	19.0218	19.3419	19.5520	19.6746	19.6980	19.6955	19.6509	19.4118	18.9424	18.4907 (90)
MIT	19.2273	19.4347	19.7371	20.0696	20.3040	20.4479	20.4860	20.4843	20.4153	20.1385	19.6425	19.1838 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2273	19.4347	19.7371	20.0696	20.3040	20.4479	20.4860	20.4843	20.4153	20.1385	19.6425	19.1838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9130	0.8806	0.8275	0.7399	0.6207	0.4460	0.2894	0.2982	0.5195	0.7397	0.8713	0.9227 (94)
Ext temp.	519.8467	566.7829	578.1933	547.6952	460.6401	322.0172	200.8340	200.8044	341.1554	458.2649	494.2595	497.8049 (95)
Heat loss rate W	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)
Space heating kWh	998.6827	969.6160	868.3132	713.2357	535.0454	340.5435	204.1475	204.4367	372.1994	596.1994	818.3829	992.7760 (97)
Space heating requirement - total per year (kWh/year)	356.2540	270.7039	215.8493	119.1892	55.3575	0.0000	0.0000	0.0000	0.0000	102.6232	233.3688	368.2585 (98a)
Solar heating kWh												1721.6044
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	356.2540	270.7039	215.8493	119.1892	55.3575	0.0000	0.0000	0.0000	0.0000	102.6232	233.3688	368.2585 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1721.6044
Space heating per m2										(98c) / (4) =		35.1850 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	356.2540	270.7039	215.8493	119.1892	55.3575	0.0000	0.0000	0.0000	0.0000	102.6232	233.3688	368.2585 (98)
Space heating fuel (main heating system)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating efficiency (main heating system 2)	209.5612	159.2376	126.9701	70.1113	32.5633	0.0000	0.0000	0.0000	0.0000	60.3666	137.2758	216.6227 (211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating	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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	107.0476	113.9143	100.5387	97.7371	83.8706	82.7474	86.0256	86.9657	101.6406	107.6649	119.6532 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(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												1012.7085	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1208.7362	(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)												114.0548	(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												2335.4995	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1012.7085	28.4300	287.9130	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1208.7362	28.4300	343.6437	(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	114.0548	28.4300	32.4258	(250)
Additional standing charges			0.0000	(251)
Total energy cost			663.9825	(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	1012.7085	0.1557	157.6352	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1208.7362	0.1412	170.6246	(264)
Space and water heating			328.2598	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	114.0548	0.1443	16.4616	(268)
Total CO2, kg/year			344.7214	(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	1012.7085	1.5763	1596.2932	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1208.7362	1.5220	1839.6663	(278)
Space and water heating			3435.9595	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	114.0548	1.5338	174.9411	(282)
Total Primary energy kWh/year			3610.9006	(286)

SAP 10 EPC IMPROVEMENTS

BE LEAN annex dwelling

Current energy efficiency rating:	C 75
Current environmental impact rating:	A 95

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 3.0	-£ 93	-41 kg (11.9%)
U Solar photovoltaic panels	+ 7.6	-£ 218	-104 kg (34.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£93	0.84 kg/m ²	C 78 A 95
Solar photovoltaic panels	£218	2.13 kg/m ²	B 86 A 97
Total Savings	£311	2.97 kg/m ²	

Potential energy efficiency rating:	B 86
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£664	£571	£93
Space heating	£288	£312	-£24
Water heating	£344	£227	£117
Lighting	£32	£32	£0
Generated (PV)	-£0	-£218	£218
Total cost of fuels	£664	£353	£311
Total cost of uses	£664	£353	£311
Delivered energy	48 kWh/m ²	25 kWh/m ²	22 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.1 tonnes
CO2 emissions per m ²	7 kg/m ²	4 kg/m ²	3 kg/m ²
Primary energy	74 kWh/m ²	40 kWh/m ²	33 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	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (5)

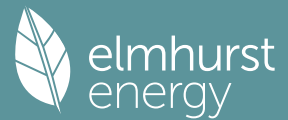
2. Ventilation rate

	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	2 * 10 = 20.0000 (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 20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infiltr rate	0.4484 0.4396 0.4308 0.3868 0.3780 0.3341 0.3341 0.3253 0.3517 0.3780 0.3956 0.4132 (22b)
Effective ac	0.6005 0.5966 0.5928 0.5748 0.5715 0.5558 0.5558 0.5529 0.5618 0.5715 0.5783 0.5854 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1100	5.3823	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.5638		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7460.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							152.4709 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0620	0.3577	
E3 Sill				5.7700	0.0390	0.2250	
E4 Jamb				9.6400	0.0520	0.5013	
E5 Ground floor (normal)				22.8400	0.0750	1.7130	
E16 Corner (normal)				6.2500	0.0360	0.2250	
E18 Party wall between dwellings				6.2800	0.0990	0.6217	
P1 Party wall - Ground floor				5.7170	0.0800	0.4574	
E11 Eaves (insulation at rafter level)				17.1400	0.0080	0.1371	
E13 Gable (insulation at rafter level)				6.4000	0.0510	0.3264	
P5 Party wall - Roof (insulation at rafter level)				6.4000	0.1110	0.7104	
R4 Ridge (vaulted ceiling)				8.5700	-0.0200	-0.1714	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1037 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	38.6675 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Heat transfer coeff	69.1145	68.9166	68.7226	67.8115	67.6410	66.8475	66.8475	66.7005	67.1531	67.6410	67.9859	68.3464	(39)
Average = Sum(39)m / 12 =												67.8107	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4125	1.4085	1.4045	1.3859	1.3824	1.3662	1.3662	1.3632	1.3724	1.3824	1.3895	1.3968	(40)
HLP (average)												1.3859	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586 (42)
Hot water usage for mixer showers													
66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	66.5147	(42a)
Hot water usage for baths													
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	(42b)
Hot water usage for other uses													
31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	31.6162	(42c)
Average daily hot water use (litres/day)												90.3022	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	(44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)
Energy content (annual)										Total = Sum(45)m =		1500.0391	
Distribution loss (46)m = 0.15 x (45)m													
23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	23.0474	(46)
Water storage loss (or HIU loss):													
Store volume												80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6000	(55)
Total storage loss													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(56)
If cylinder contains dedicated solar storage													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(57)
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612	(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													
205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304	203.4104	203.4104	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												570.7779	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												570.7779	
Solar input	-0.0000	-16.2883	-56.1098	-74.9805	-94.4978	-85.6431	-84.6727	-75.8290	-54.3789	-28.3777	-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	(64a)
Output from w/h													
205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304	203.4104	203.4104	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705	90.8973	90.8973	(65)

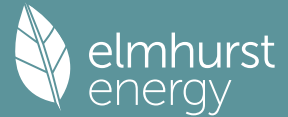
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944	16.5944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918	206.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)													
123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738	122.1738	(72)
Total internal gains													
437.6781	436.2766	422.4534	391.9602	361.5287	334.3078	322.2661	325.3252	343.5614	379.3001	405.9942	427.6434	427.6434	(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
South	6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)
West	3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)

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Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	556.0504	636.4863	692.0270	717.7085	718.1575	684.5502	661.5353	642.2602	632.7655	599.4547	547.5321	529.0962 (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	29.9841	30.0702	30.1551	30.5602	30.6372	31.0009	31.0009	31.0692	30.8598	30.6372	30.4818	30.3210
alpha	2.9989	3.0047	3.0103	3.0373	3.0425	3.0667	3.0667	3.0713	3.0573	3.0425	3.0321	3.0214
util living area	0.9387	0.9100	0.8673	0.8002	0.7008	0.5599	0.4233	0.4506	0.6269	0.8092	0.9096	0.9457 (86)
MIT	19.4926	19.7181	20.0156	20.3481	20.6174	20.7997	20.8681	20.8607	20.7499	20.4101	19.8998	19.4531 (87)
Th 2	19.7537	19.7568	19.7599	19.7742	19.7768	19.7894	19.7894	19.7917	19.7845	19.7768	19.7714	19.7658 (88)
util rest of house	0.9269	0.8934	0.8428	0.7624	0.6423	0.4736	0.3154	0.3428	0.5447	0.7656	0.8901	0.9352 (89)
MIT 2	18.4233	18.6420	18.9275	19.2476	19.4855	19.6381	19.6790	19.6781	19.6009	19.3137	18.8340	18.3946 (90)
Living area fraction									fLA = Living area / (4) =			0.6626 (91)
MIT	19.1318	19.3550	19.6485	19.9768	20.2355	20.4078	20.4669	20.4617	20.3622	20.0402	19.5402	19.0960 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1318	19.3550	19.6485	19.9768	20.2355	20.4078	20.4669	20.4617	20.3622	20.0402	19.5402	19.0960 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9200	0.8873	0.8403	0.7692	0.6655	0.5192	0.3771	0.4041	0.5856	0.7759	0.8859	0.9284 (94)
Useful gains	511.5613	564.7383	581.5334	552.0330	477.9292	355.4515	249.4676	259.5227	370.5592	465.0950	485.0518	491.1964 (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	1025.0924	996.1893	903.5973	751.1308	577.3488	388.2342	258.4894	270.9167	420.5238	638.5418	845.7563	1018.0853 (97)
Space heating kWh	382.0671	289.9351	239.6155	143.3504	73.9682	0.0000	0.0000	0.0000	0.0000	129.0444	259.7072	392.0053 (98a)
Space heating requirement - total per year (kWh/year)												1909.6932
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	382.0671	289.9351	239.6155	143.3504	73.9682	0.0000	0.0000	0.0000	0.0000	129.0444	259.7072	392.0053 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1909.6932
Space heating per m2										(98c) / (4) =		39.0291 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	382.0671	289.9351	239.6155	143.3504	73.9682	0.0000	0.0000	0.0000	0.0000	129.0444	259.7072	392.0053 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	224.7454	170.5501	140.9503	84.3238	43.5107	0.0000	0.0000	0.0000	0.0000	75.9085	152.7689	230.5914 (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	205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304	203.4104 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	97.4663	79.8087	51.1108	32.0686	26.0766	25.2771	34.3048	51.7999	83.8481	107.6649	119.6532 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-36.9574	-54.0154	-78.3349	-85.4539	-85.4564	-70.9276	-69.9454	-68.0181	-63.3758	-59.7348	-40.9526	-31.7383 (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												1123.3490 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												830.0093 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)

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Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	114.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-744.9107 (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	1402.5025 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1123.3490	16.4900	185.2402 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	830.0093	16.4900	136.8685 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	114.0548	16.4900	18.8076 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-744.9107	16.4900	-122.8358
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-122.8358 (252)
Total energy cost			231.2727 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.8864 (257)
SAP value	85.6317
SAP rating (Section 12)	86 (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	1123.3490	0.1551	174.2667 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	830.0093	0.1474	122.3198 (264)
Space and water heating			296.5864 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	114.0548	0.1443	16.4616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-744.9107	0.1359	-101.2582
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-101.2582 (269)
Total CO2, kg/year			222.8869 (272)
CO2 emissions per m2			4.5600 (273)
EI value			96.8203
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

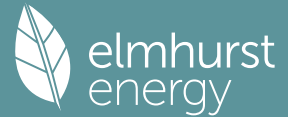
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6402 (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	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1302 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3802 (18)
Number of sides sheltered 1 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3517 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000	(22)
Adj infilt rate	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000	(22a)
Effective ac	0.3868	0.3780	0.3780	0.3341	0.3341	0.2901	0.2901	0.2989	0.2989	0.3253	0.3341	0.3517	(22b)
	0.5748	0.5715	0.5715	0.5558	0.5558	0.5421	0.5421	0.5447	0.5447	0.5529	0.5558	0.5618	(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								
Windows			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1100	5.3823	110.0000	5382.3000	(28a)
External Wall	71.6000	10.2100	61.3900	0.1700	10.4363	18.0000	1105.0200	(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 33.5638			(33)
Main dwelling								
GF			53.0800			9.0000	477.7200	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 7460.4000 (34)
List of Thermal Bridges 152.4709 (35)

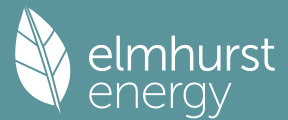
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577	
E3 Sill	5.7700	0.0390	0.2250	
E4 Jamb	9.6400	0.0520	0.5013	
E5 Ground floor (normal)	22.8400	0.0750	1.7130	
E16 Corner (normal)	6.2500	0.0360	0.2250	
E18 Party wall between dwellings	6.2800	0.0990	0.6217	
P1 Party wall - Ground floor	5.7170	0.0800	0.4574	
E11 Eaves (insulation at rafter level)	17.1400	0.0080	0.1371	
E13 Gable (insulation at rafter level)	6.4000	0.0510	0.3264	
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104	
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.1037	(36)
Point Thermal bridges			0.0000	(36a) =
Total fabric heat loss			38.6675	(33) + (36) + (36a) = (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	29.1440	28.9735	28.9735	28.1800	28.1800	27.4844	27.4844	27.6157	27.6157	28.0330	28.1800	28.4856	(38)
Heat transfer coeff	67.8115	67.6410	67.6410	66.8475	66.8475	66.1519	66.1519	66.2832	66.2832	66.7005	66.8475	67.1531	(39)
Average = Sum(39)m / 12 =												66.8633	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3859	1.3824	1.3824	1.3662	1.3662	1.3520	1.3520	1.3547	1.3547	1.3632	1.3662	1.3724	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.3665	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586	(42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)	
Average daily hot water use (litres/day)													90.3022	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	(44)	
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)	
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)	
Water storage loss (or HIU loss):														
Store volume													80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.6000	(55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(56)	
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(57)	
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612	(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	205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304	203.4104	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)

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Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												625.3455 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												625.3455
Solar input	-0.0000	-19.3083	-59.6151	-80.5194	-97.7685	-92.6874	-90.7902	-82.8081	-61.3341	-35.8541	-4.6602	-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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)
								Total per year (kWh/year) = Sum(64)m =				1356.4482 (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	91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705	90.8973 (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	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)	123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738	(72)
Total internal gains	437.6781	436.2766	422.4534	391.9602	361.5287	334.3078	322.2661	325.3252	343.5614	379.3001	405.9942	427.6434	(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					
South		6.8900	51.7504	0.6300	0.7000	0.7700	108.9694 (78)					
West		3.3200	22.4175	0.6300	0.7000	0.7700	22.7456 (80)					
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889	111.8388 (83)
Total gains	569.3931	643.6585	696.7024	730.1316	723.7254	707.9382	680.0138	660.2727	650.6398	617.4943	567.2831	539.4823 (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	30.5602	30.6372	30.6372	31.0009	31.0009	31.3269	31.3269	31.2649	31.2649	31.0692	31.0009	30.8598	
alpha	3.0373	3.0425	3.0425	3.0667	3.0667	3.0885	3.0885	3.0843	3.0843	3.0713	3.0667	3.0573	
util living area	0.9325	0.9037	0.8558	0.7763	0.6666	0.4941	0.3412	0.3512	0.5650	0.7754	0.8962	0.9408	(86)
MIT	19.5837	19.7935	20.0987	20.4309	20.6769	20.8390	20.8867	20.8853	20.8027	20.5066	19.9991	19.5367	(87)
Th 2	19.7742	19.7768	19.7768	19.7894	19.7894	19.8003	19.8003	19.7983	19.7983	19.7917	19.7894	19.7845	(88)
util rest of house	0.9197	0.8862	0.8294	0.7349	0.6031	0.4032	0.2315	0.2385	0.4759	0.7255	0.8743	0.9294	(89)
MIT 2	18.5275	18.7303	19.0195	19.3342	19.5449	19.6733	19.6978	19.6953	19.6498	19.4103	18.9424	18.4907	(90)
Living area fraction									fLA = Living area / (4) =			0.6626	(91)
MIT	19.2273	19.4347	19.7346	20.0608	20.2949	20.4457	20.4855	20.4837	20.4137	20.1367	19.6425	19.1838	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2273	19.4347	19.7346	20.0608	20.2949	20.4457	20.4855	20.4837	20.4137	20.1367	19.6425	19.1838	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9130	0.8806	0.8283	0.7449	0.6309	0.4534	0.2950	0.3038	0.5232	0.7409	0.8713	0.9227	(94)
Useful gains	519.8467	566.7829	577.1081	543.8674	456.5943	321.0112	200.6138	200.5756	340.4402	457.5068	494.2595	497.8049	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	998.6827	969.6160	868.1429	712.6499	534.4417	340.3956	204.1121	204.4000	372.0939	596.0833	818.3829	992.7760	(97)
Space heating kWh	356.2540	270.7039	216.5299	121.5234	57.9185	0.0000	0.0000	0.0000	0.0000	103.1009	233.3688	368.2585	(98a)
Space heating requirement - total per year (kWh/year)												1727.6578	
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	356.2540	270.7039	216.5299	121.5234	57.9185	0.0000	0.0000	0.0000	0.0000	103.1009	233.3688	368.2585	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1727.6578	
Space heating per m ²												35.3088	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	170.0000 (206)

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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	356.2540	270.7039	216.5299	121.5234	57.9185	0.0000	0.0000	0.0000	0.0000	103.1009	233.3688	368.2585 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	209.5612	159.2376	127.3705	71.4844	34.0697	0.0000	0.0000	0.0000	0.0000	60.6476	137.2758	216.6227 (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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	120.9304	95.6898	77.7468	47.8527	30.1447	21.9329	21.6785	30.1994	47.7086	79.4502	104.9236	119.6532 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-40.7437	-55.8352	-79.2483	-86.1196	-84.3800	-71.8866	-70.7387	-69.2006	-65.3452	-62.5985	-45.6398	-34.7819 (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												1016.2693 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												797.9107 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												114.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-766.5181 (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												1241.7168 (238)

10a. Fuel costs - using BEDF prices (589)												
						Fuel		Fuel price			Fuel cost	
						kWh/year		p/kWh			£/year	
Space heating - main system 1						1016.2693		28.4300			288.9254 (240)	
Total CO2 associated with community systems											0.0000 (473)	
Water heating (other fuel)						797.9107		28.4300			226.8460 (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)	
Pump for solar water heating						80.0000		28.4300			22.7440 (249)	
Energy for lighting						114.0548		28.4300			32.4258 (250)	
Additional standing charges											0.0000 (251)	
Energy saving/generation technologies												
PV Unit electricity used in dwelling						-766.5181		28.4300			-217.9211	
PV Unit electricity exported						0.0000		5.8100			0.0000	
Total											-217.9211 (252)	
Total energy cost											353.0201 (255)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP												
						Energy		Emission factor			Emissions	
						kWh/year		kg CO2/kWh			kg CO2/year	
Space heating - main system 1						1016.2693		0.1556			158.1298 (261)	
Total CO2 associated with community systems											0.0000 (373)	
Water heating (other fuel)						797.9107		0.1481			118.1325 (264)	
Space and water heating											276.2624 (265)	
Pumps, fans and electric keep-hot						80.0000		0.1387			11.0970 (267)	
Energy for lighting						114.0548		0.1443			16.4616 (268)	
Energy saving/generation technologies												
PV Unit electricity used in dwelling						-766.5181		0.1362			-104.4285	
PV Unit electricity exported						0.0000		0.0000			0.0000	
Total											-104.4285 (269)	
Total CO2, kg/year											199.3924 (272)	

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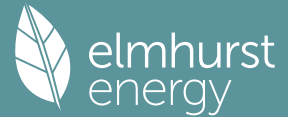


----- 13a. Primary energy - Individual heating systems including micro-CHP -----

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1016.2693	1.5760	1601.6844 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	797.9107	1.5478	1234.9723 (278)
Space and water heating			2836.6568 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	114.0548	1.5338	174.9411 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-766.5181	1.5036	-1152.5551
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1152.5551 (283)
Total Primary energy kWh/year			1980.0668 (286)

iii. Be Green

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Plot Reference	BASE/BELEAN/BEGREEN				Issued on Date	27/01/2026
Assessment Reference	BE GREEN main dwelling	Plot Type Ref	Flint House			
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD				SAP Version	10.2
SAP Rating	81 B	DER	3.85	TER	8.52	
Environmental	96 A	% DER < TER				54.81
CO ₂ Emissions (t/year)	0.82	DFEE	43.26	TFEE	44.85	
Compliance Check	See BREL	% DFEE < TFEE				3.53
% DPER < TPER	14.21	DPER	38.73	TPER	45.14	
Assessor Details	Mr. Neil Bradford				Assessor ID	T704-0001
Client	Flint House, Joe Reader					

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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (5)

2. Ventilation rate

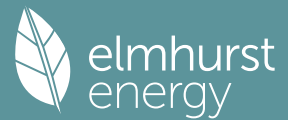
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2597 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2597 (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	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (22b)
Effective ac	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

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

(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
107.3765 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180

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

(36a) = 17.8404 (36)
(33) + (36) + (36a) = 169.8914 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080	(38)
Heat transfer coeff	292.6267	292.1559	291.6944	289.5269	289.1213	287.2335	287.2335	286.8839	287.9606	289.1213	289.9417	290.7994	(39)
Average = Sum(39)m / 12 =													289.5249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353	(40)
HLP (average)												1.2299	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

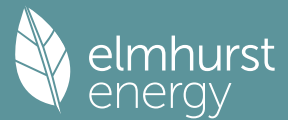
Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)
Hot water usage for baths	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)
Average daily hot water use (litres/day)													141.2695 (43)
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)
Energy content	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	
Distribution loss (46)m = $0.15 \times (45)\text{m}$	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)
Water storage loss (or HIU loss):													200.0000 (47)
Store volume													1.4300 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.6000 (49)
Temperature factor from Table 2b													0.8580 (55)
Enter (49) or (54) in (55)													
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2995.4399	(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	127.1369	112.9471	121.0262	108.5907	106.8105	91.7876	91.3806	94.2449	94.4546	110.1851	114.8091	126.0098	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	170.8829	168.0761	162.6696	150.8205	143.5625	127.4827	122.8234	126.6733	131.1870	148.0982	159.4570	169.3679	(72)
Total internal gains	846.7229	869.9131	832.1443	804.6141	762.2116	726.2630	697.0121	696.6742	718.5261	751.1184	797.6218	827.4015	(73)

6. Solar gains

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[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	
North	7.1100		10.6334		0.6300		0.7000		0.7700		23.1054	(74)
East	21.7500		19.6403		0.6300		0.7000		0.7700		130.5505	(76)
South	19.3500		46.7521		0.6300		0.7000		0.7700		276.4736	(78)
West	27.3600		19.6403		0.6300		0.7000		0.7700		164.2235	(80)
East	1.6900		26.6072		0.6300		0.7000		1.0000		17.8471	(82)
West	1.6900		26.6072		0.6300		0.7000		1.0000		17.8471	(82)
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541 (83)
Total gains	1476.7700	2015.6648	2558.2866	3153.1041	3543.6659	3543.1946	3390.4966	3065.7974	2663.7439	2063.4531	1566.3143	1357.0556 (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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097
util living area	0.9685	0.9339	0.8725	0.7604	0.6182	0.4698	0.3548	0.4025	0.6118	0.8427	0.9466	0.9742 (86)
Living	18.7964	19.1788	19.6756	20.2131	20.5810	20.7781	20.8466	20.8315	20.6664	20.1143	19.3399	18.7270
Non living	17.3046	17.7862	18.4030	19.0529	19.4698	19.6773	19.7356	19.7273	19.5771	18.9585	18.0015	17.2209
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	20	0	0	0	0	0	0	0	0	0	31
16 / 9	0	8	31	11	0	0	0	0	0	0	30	0
MIT	21.0000	20.7053	20.2499	20.3382	20.5810	20.7781	20.8466	20.8315	20.6664	20.1143	20.0598	21.0000 (87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)
util rest of house	0.9633	0.9237	0.8535	0.7270	0.5681	0.4020	0.2727	0.3161	0.5430	0.8113	0.9366	0.9700 (89)
MIT 2	19.8857	19.6223	19.2330	19.2256	19.4698	19.6773	19.7356	19.7273	19.5771	18.9585	19.0591	19.8919 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	20.1386	19.8681	19.4638	19.4781	19.7220	19.9271	19.9877	19.9779	19.8243	19.2208	19.2862	20.1433 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1386	19.8681	19.4638	19.4781	19.7220	19.9271	19.9877	19.9779	19.8243	19.2208	19.2862	20.1433 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9646	0.9235	0.8453	0.7129	0.5595	0.4035	0.2792	0.3221	0.5377	0.7881	0.9299	0.9710 (94)
Useful gains	1424.4655	1861.3888	2162.4908	2247.8468	1982.6872	1429.8152	946.7460	987.3519	1432.2266	1626.1355	1456.5688	1317.7091 (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	4634.7889	4373.0143	3781.4677	3062.6391	2319.3234	1530.1254	973.0687	1026.4280	1648.3621	2492.4597	3533.2820	4636.3120 (97)
Space heating kWh	2388.4806	1687.8124	1204.5188	586.6505	250.4573	0.0000	0.0000	0.0000	0.0000	644.5452	1495.2336	2469.0406 (98a)
Space heating requirement - total per year (kWh/year)												10726.7388
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	2388.4806	1687.8124	1204.5188	586.6505	250.4573	0.0000	0.0000	0.0000	0.0000	644.5452	1495.2336	2469.0406 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10726.7388
Space heating per m2										(98c) / (4) =		45.5662 (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 %)												205.0538 (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	2388.4806	1687.8124	1204.5188	586.6505	250.4573	0.0000	0.0000	0.0000	0.0000	644.5452	1495.2336	2469.0406 (98)
Space heating efficiency (main heating system 1)	205.0538	205.0538	205.0538	205.0538	205.0538	0.0000	0.0000	0.0000	0.0000	205.0538	205.0538	205.0538 (210)
Space heating fuel (main heating system)	1164.8069	823.1071	587.4160	286.0959	122.1423	0.0000	0.0000	0.0000	0.0000	314.3298	729.1909	1204.0941 (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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664 (64)
Efficiency of water heater												172.8947 (216)
(217)m	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947 (217)
Fuel for water heating, kWh/month	174.1848	154.0472	163.5551	143.4388	138.8268	120.4258	118.4099	123.3924	125.0652	144.6970	154.2556	172.2241 (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	41.4299	33.2366	29.9259	21.9250	16.9355	13.8364	15.4491	20.0813	26.0837	34.2232	38.6550	42.5813 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-57.6752	-87.4752	-142.0328	-183.1675	-209.0482	-183.5451	-178.2841	-156.9925	-122.9506	-99.7978	-64.2826	-49.6055 (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)												

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(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												5231.1830	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.8947	
Water heating fuel used												1732.5229	(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)												334.3629	(232)
Energy saving/generation technologies (Appendices M,N and Q)													
PV generation												-1534.8571	(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												5763.2117	(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	5231.1830	0.1563	817.5938	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1732.5229	0.1412	244.6169	(264)
Space and water heating			1062.2108	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	334.3629	0.1443	48.2589	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1534.8571	0.1334	-204.6784	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-204.6784	(269)
Total CO2, kg/year			905.7913	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8500	(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	5231.1830	1.5786	8257.8493	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1732.5229	1.5221	2637.0592	(278)
Space and water heating			10894.9085	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	334.3629	1.5338	512.8570	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1534.8571	1.4928	-2291.2224	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-2291.2224	(283)
Total Primary energy kWh/year			9116.5431	(286)
Dwelling Primary energy Rate (DPER)			38.7300	(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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)	
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (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)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	40.0000 / (5) =											
Pressure Test Method	Yes											
Measured/design AP50	Blower Door											
Infiltration rate	5.0000 (17)											
Number of sides sheltered	0.3097 (18)											
	0 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] =											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											
	1.0000 (20)											
	0.3097 (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)
	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (22b)
Effective ac	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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 Opening Type			56.3500	1.1450	64.5229		(27)
TER Roof Light			2.5200	1.5918	5.0956		(27a)
GF			122.0000	0.1300	15.8600		(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152		(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284		(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496		(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756		(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983		(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959		(30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		138.4415		(33)

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

107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0500	2.0110
E3 Sill	40.2200	0.0500	2.0110
E4 Jamb	65.3800	0.0500	3.2690
E5 Ground floor (normal)	46.4800	0.1600	7.4368
E6 Intermediate floor within a dwelling	46.5100	0.0000	0.0000
E16 Corner (normal)	22.9200	0.0900	2.0628
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0800	1.2560
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0800	0.3808
E14 Flat roof	7.4210	0.0800	0.5937
R2 Sill of roof window	4.7600	0.0600	0.2856
R3 Jamb of roof window	2.8600	0.0800	0.2288
E11 Eaves (insulation at rafter level)	22.3000	0.0400	0.8920
R4 Ridge (vaulted ceiling)	20.9000	0.0800	1.6720

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

23.6619 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 162.1033 (37)

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

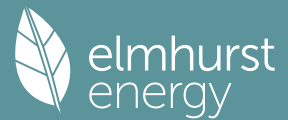
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2180	122.8687	124.0354	125.2552 (38)
Average = Sum(39)m / 12 =	289.9573	289.2877	288.6314	285.5488	284.9720	282.2871	282.2871	281.7899	283.3213	284.9720	286.1388	287.3586 (39)
												285.5460

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2317	1.2289	1.2261	1.2130	1.2105	1.1991	1.1991	1.1970	1.2035	1.2105	1.2155	1.2207 (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	3.0480 (42)											
Hot water usage for mixer showers	75.3242 74.1922 72.5427 69.3867 67.0576 64.4602 62.9839 64.6209 66.4154 69.2042 72.4280 75.0356 (42a)											
Hot water usage for baths	32.5151 32.0322 31.3522 30.0983 29.1595 28.1185 27.5561 28.2314 28.9666 30.0806 31.3602 32.4052 (42b)											
Hot water usage for other uses	45.8442 44.1771 42.5101 40.8430 39.1759 37.5089 37.5089 39.1759 40.8430 42.5101 44.1771 45.8442 (42c)											
Average daily hot water use (litres/day)	141.2695 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)
Energy content (annual)	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 2346.4575											
Water storage loss (or HIU loss):	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)
Store volume	200.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.6525 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.8924 (55)											
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (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	294.3231	260.1675	275.9450	241.3853	233.1911	209.2411	205.7901	214.4046	217.2624	243.3403	260.0871	290.9333 (62)
WWHRS	-34.4351	-30.4547	-31.8904	-26.4065	-24.6099	-21.0589	-19.7393	-20.9908	-21.7883	-25.6860	-29.0991	-33.7974 (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)

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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	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2626.1147 (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	121.6704	108.0096	115.5597	103.3006	101.3440	92.6126	92.2332	95.0975	95.2797	104.7186	109.5189	120.5432 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	163.5355	160.7286	155.3221	143.4730	136.2150	128.6286	123.9693	127.8192	132.3329	140.7508	152.1096	162.0205	(72)
Total internal gains	842.3755	865.5657	827.7969	800.2667	757.8641	727.4089	698.1580	697.8201	719.6720	746.7709	793.2743	823.0540	(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		
North					5.3000	10.6334		0.6300	0.7000		0.7700		17.2234 (74)		
East					16.2300	19.6403		0.6300	0.7000		0.7700		97.4177 (76)		
South					14.4300	46.7521		0.6300	0.7000		0.7700		206.1764 (78)		
West					20.3900	19.6403		0.6300	0.7000		0.7700		122.3873 (80)		
East					1.2600	26.6072		0.6300	0.7000		1.0000		13.3061 (82)		
West					1.2600	26.6072		0.6300	0.7000		1.0000		13.3061 (82)		
Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021	394.9560	(83)		
Total gains	1312.1925	1719.9317	2114.9390	2551.4630	2831.8961	2827.8898	2706.5911	2464.3971	2170.1682	1725.3520	1366.4765	1218.0100	(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	24.2157	24.2718	24.3270	24.5896	24.6394	24.8737	24.8737	24.9176	24.7829	24.6394	24.5389	24.4347	
alpha	2.6144	2.6181	2.6218	2.6393	2.6426	2.6582	2.6582	2.6612	2.6522	2.6426	2.6359	2.6290	
util living area	0.9758	0.9522	0.9097	0.8242	0.7010	0.5519	0.4257	0.4761	0.6873	0.8838	0.9599	0.9798	(86)
MIT	18.1236	18.5592	19.1707	19.9013	20.4592	20.7992	20.9266	20.8997	20.6223	19.8300	18.8360	18.0547	(87)
Th 2	19.8947	19.8970	19.8992	19.9096	19.9116	19.9207	19.9207	19.9224	19.9172	19.9116	19.9076	19.9035	(88)
util rest of house	0.9717	0.9445	0.8951	0.7960	0.6533	0.4797	0.3325	0.3806	0.6205	0.8583	0.9521	0.9765	(89)
MIT 2	16.5304	17.0821	17.8496	18.7493	19.4002	19.7685	19.8816	19.8651	19.6019	18.6881	17.4454	16.4476	(90)
Living area fraction	FLA = Living area / (4) =												0.2269 (91)
MIT	16.8919	17.4173	18.1494	19.0108	19.6405	20.0024	20.1187	20.0999	19.8335	18.9472	17.7609	16.8123	(92)
Temperature adjustment													0.0000
adjusted MIT	16.8919	17.4173	18.1494	19.0108	19.6405	20.0024	20.1187	20.0999	19.8335	18.9472	17.7609	16.8123	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9548	0.9198	0.8648	0.7684	0.6401	0.4855	0.3504	0.3972	0.6148	0.8295	0.9297	0.9615	(94)
Ext temp.	1252.8222	1582.0234	1828.8937	1960.4999	1812.6326	1373.0654	948.3664	978.8965	1334.1647	1431.2053	1270.4638	1171.1118	(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	3651.1185	3621.0966	3362.3796	2887.1142	2262.8280	1525.0214	993.2893	1042.5851	1624.4198	2378.7260	3050.5087	3624.2459	(97)
Space heating requirement - total per year (kWh/year)	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318	(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)
Space heating contribution - total per year (kWh/year)	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													9109.3303
Space heating per m2	(98c) / (4) =												38.6956 (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)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1784.3324	1370.2572	1140.9135	667.1624	334.9453	0.0000	0.0000	0.0000	0.0000	704.9554	1281.6323	1825.1318	(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)	1933.1879	1484.5690	1236.0926	722.8195	362.8877	0.0000	0.0000	0.0000	0.0000	763.7653	1388.5507	1977.3909	(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	259.8880	229.7129	244.0547	214.9789	208.5812	188.1823	186.0508	193.4138	195.4741	217.6543	230.9879	257.1359	(64)
Efficiency of water heater (217)m	87.5448	87.3850	87.0696	86.4246	85.1161	79.8000	79.8000	79.8000	79.8000	86.4986	87.2965	79.8000	(216)
Fuel for water heating, kWh/month	296.8631	262.8744	280.2984	248.7473	245.0549	235.8174	233.1463	242.3732	244.9550	251.6276	264.6015	293.6003	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.2944	33.9301	30.5503	22.3825	17.2889	14.1251	15.7715	20.5004	26.6279	34.9373	39.4616	43.4699	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-98.3357	-131.3023	-178.7761	-189.9062	-195.6573	-179.1549	-176.5667	-170.7699	-159.7637	-144.2435	-105.2937	-85.8686	(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)	-80.2964	-165.2852	-322.2035	-475.2415	-620.4428	-620.8396	-613.8577	-523.6274	-388.8196	-233.7950	-106.2978	-63.8108	(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												9869.2636	(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												3099.9594	(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)												341.3397	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6030.1557	(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												7366.4070	(238)

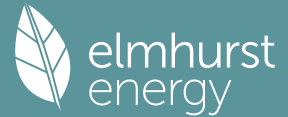
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9869.2636	0.2100	2072.5454	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3099.9594	0.2100	650.9915	(264)
Space and water heating			2723.5368	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	341.3397	0.1443	49.2659	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1815.6384	0.1358	-246.6011	
PV Unit electricity exported	-4214.5173	0.1264	-532.8271	
Total			-779.4282	(269)
Total CO2, kg/year			2005.3037	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.5200	(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	9869.2636	1.1300	11152.2678	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3099.9594	1.1300	3502.9541	(278)
Space and water heating			14655.2220	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	341.3397	1.5338	523.5583	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1815.6384	1.5020	-2727.1576	
PV Unit electricity exported	-4214.5173	0.4641	-1955.9374	
Total			-4683.0951	(283)
Total Primary energy kWh/year			10625.7860	(286)
Target Primary Energy Rate (TPER)			45.1400	(287)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2597 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2597 (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	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (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	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
107.3765 (35)

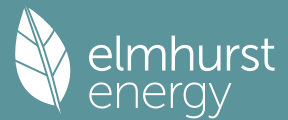
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.8404 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 169.8914 (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	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080 (38)
Heat transfer coeff	292.6267	292.1559	291.6944	289.5269	289.1213	287.2335	287.2335	286.8839	287.9606	289.1213	289.9417	290.7994 (39)

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Average = Sum(39)m / 12 =

289.5249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353	(40)
HLP (average)												1.2299	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480 (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													
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052		(42b)
Hot water usage for other uses													
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442		(42c)
Average daily hot water use (litres/day)												71.8231	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.3593	76.2093	73.8622	70.9414	68.3354	65.6273	65.0650	67.4073	69.8096	72.5906	75.5374	78.2494	(44)
Energy conte	124.1019	108.5211	113.5235	97.1152	91.9926	80.6965	78.6905	83.4644	86.0823	98.5048	107.6168	122.5196	(45)
Energy content (annual)													
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):													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													
105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416		(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													
105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416		(64)
Total per year (kWh/year)													
1013.9048													(64)
Electric shower(s)													
60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221		(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												686.1607	(64a)
Heat gains from water heating, kWh/month													
41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159		(65)

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

Metabolic gains (Table 5), Watts													
(66)m	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185		(71)
Water heating gains (Table 5)													
55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634		(72)
Total internal gains													
731.5553	756.1490	721.6203	701.9032	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969		(73)

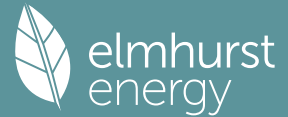
6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North				7.1100	10.6334		0.6300		0.7000		0.7700	23.1054 (74)
East				21.7500	19.6403		0.6300		0.7000		0.7700	130.5505 (76)
South				19.3500	46.7521		0.6300		0.7000		0.7700	276.4736 (78)
West				27.3600	19.6403		0.6300		0.7000		0.7700	164.2235 (80)
East				1.6900	26.6072		0.6300		0.7000		1.0000	17.8471 (82)
West				1.6900	26.6072		0.6300		0.7000		1.0000	17.8471 (82)
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541 (83)
Total gains	1361.6024	1901.9006	2447.7626	3050.3931	3445.5510	3458.4272	3309.0473	2982.1359	2577.4101	1963.2108	1458.6146	1242.9510 (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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456	
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097	
util living area													
0.9737	0.9413	0.8822	0.7715	0.6293	0.4790	0.3626	0.4121	0.6248	0.8555	0.9541	0.9789		(86)
MIT	18.1348	18.6543	19.3323	20.0709	20.5790	20.8527	20.9480	20.9264	20.6952	19.9268	18.8692	18.0408	(87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8978	19.8948	19.8919	(88)
util rest of house													
0.9693	0.9320	0.8643	0.7388	0.5792	0.4104	0.2790	0.3242	0.5560	0.8257	0.9453	0.9753		(89)

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MIT 2	17.2780	17.7892	18.4469	19.1447	19.5949	19.8196	19.8831	19.8736	19.7091	19.0348	18.0124	17.1890 (90)
Living area fraction									FLA = Living area / (4) =			0.2269 (91)
MIT	17.4724	17.9855	18.6478	19.3548	19.8182	20.0540	20.1248	20.1125	19.9328	19.2372	18.2068	17.3823 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4724	17.9855	18.6478	19.3548	19.8182	20.0540	20.1248	20.1125	19.9328	19.2372	18.2068	17.3823 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9557	0.9111	0.8398	0.7207	0.5754	0.4202	0.2964	0.3415	0.5581	0.8041	0.9268	0.9636	(94)
Useful gains	1301.3034	1732.8912	2055.6458	2198.4658	1982.4786	1453.4000	980.8052	1018.3666	1438.5049	1578.6576	1351.8942	1197.7370	(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													
	3854.6106	3823.0081	3543.4437	3026.9594	2347.1576	1566.5819	1012.4393	1065.0495	1679.6267	2497.2083	3220.3253	3833.4029	(97)
Space heating kWh													
	1899.6606	1404.5586	1106.9217	596.5154	271.3212	0.0000	0.0000	0.0000	0.0000	683.4017	1345.2704	1960.9354	(98a)
Space heating requirement - total per year (kWh/year)												9268.5850	
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													
	1899.6606	1404.5586	1106.9217	596.5154	271.3212	0.0000	0.0000	0.0000	0.0000	683.4017	1345.2704	1960.9354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9268.5850	
Space heating per m2											(98c) / (4) =	39.3721	(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	2699.9945	2125.5276	2180.3173	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8416	0.8877	0.8584	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2272.1897	1886.8483	1871.4763	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3905.0180	3736.5388	3365.1785	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	1175.6363	1376.1697	1111.3145	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	293.9091	344.0424	277.8286	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												915.7801	(107)
Energy for space heating												39.3721	(99)
Energy for space cooling												3.8901	(108)
Total												43.2622	(109)
Fabric Energy Efficiency (DFEE)												43.3	(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	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)	
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (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) =	0.0597 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3097	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3097 (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)

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Adj infilt rate	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3097	0.3329	0.3484	0.3639 (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	0.5779	0.5749	0.5720	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662 (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 Opening Type			56.3500	1.1450	64.5229		(27)
TER Roof Light			2.5200	1.5918	5.0956		(27a)
GF			122.0000	0.1300	15.8600		(28a)
GF EXT WALLS	111.1800	35.5400	75.6400	0.1800	13.6152		(29a)
1ST EXT WALLS master	43.9600	6.5800	37.3800	0.1800	6.7284		(29a)
1ST EXT WALL BEDROOM	71.4900	6.7700	64.7200	0.1800	11.6496		(29a)
1ST EXT LAND	27.8800	7.4600	20.4200	0.1800	3.6756		(29a)
MAIN ROOF	147.0500	2.5200	144.5300	0.1100	15.8983		(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959		(30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		138.4415		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0500	2.0110
E3 Sill	40.2200	0.0500	2.0110
E4 Jamb	65.3800	0.0500	3.2690
E5 Ground floor (normal)	46.4800	0.1600	7.4368
E6 Intermediate floor within a dwelling	46.5100	0.0000	0.0000
E16 Corner (normal)	22.9200	0.0900	2.0628
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0800	1.2560
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0800	0.3808
E14 Flat roof	7.4210	0.0800	0.5937
R2 Sill of roof window	4.7600	0.0600	0.2856
R3 Jamb of roof window	2.8600	0.0800	0.2288
E11 Eaves (insulation at rafter level)	22.3000	0.0400	0.8920
R4 Ridge (vaulted ceiling)	20.9000	0.0800	1.6720
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.6619 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 162.1033 (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	127.8540	127.1844	126.5281	123.4454	122.8687	120.1838	120.1838	119.6866	121.2180	122.8687	124.0354	125.2552 (38)
Average = Sum(39)m / 12 =	289.9573	289.2877	288.6314	285.5488	284.9720	282.2871	282.2871	281.7899	283.3213	284.9720	286.1388	287.3586 (39)
												285.5460
HLP	1.2317	1.2289	1.2261	1.2130	1.2105	1.1991	1.1991	1.1970	1.2035	1.2105	1.2155	1.2207 (40)
HLP (average)												1.2130
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

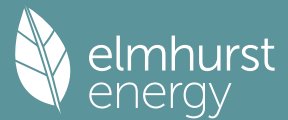
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (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	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)
Average daily hot water use (litres/day)												71.8231 (43)
Daily hot water use	78.3593	76.2093	73.8622	70.9414	68.3354	65.6273	65.0650	67.4073	69.8096	72.5906	75.5374	78.2494 (44)
Energy conte	124.1019	108.5211	113.5235	97.1152	91.9926	80.6965	78.6905	83.4644	86.0823	98.5048	107.6168	122.5196 (45)
Energy content (annual)										Total = Sum(45)m =		1192.8291
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):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (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	105.4866	92.2429	96.4950	82.5479	78.1937	68.5920	66.8869	70.9447	73.1699	83.7291	91.4743	104.1416 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				1013.9048 (64)
Electric shower(s)	60.3221	53.7475	58.6902	56.0074	57.0583	54.4281	56.2424	57.0583	56.0074	58.6902	57.5866	60.3221 (64a)
Heat gains from water heating, kWh/month	41.4522	36.4976	38.7963	34.6388	33.8130	30.7550	30.7823	32.0008	32.2943	35.6048	37.2652	41.1159 (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	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	152.3981	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.5533	225.3626	203.5533	210.3384	203.5533	210.3384	203.5533	203.5533	210.3384	203.5533	210.3384	203.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.5672	407.7550	397.2020	374.7358	346.3763	319.7224	301.9159	297.7282	308.2812	330.7474	359.1069	385.7608	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	38.2398	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	55.7153	54.3119	52.1456	48.1095	45.4476	42.7153	41.3741	43.0118	44.8532	47.8560	51.7573	55.2634	(72)
Total internal gains	731.5553	756.1490	721.6203	701.9032	664.0967	641.4956	615.5628	613.0127	632.1923	650.8761	689.9220	713.2969	(73)

6. Solar gains

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

North				5.3000	10.6334		0.6300		0.7000		0.7700		17.2234 (74)
East				16.2300	19.6403		0.6300		0.7000		0.7700		97.4177 (76)
South				14.4300	46.7521		0.6300		0.7000		0.7700		206.1764 (78)
West				20.3900	19.6403		0.6300		0.7000		0.7700		122.3873 (80)
East				1.2600	26.6072		0.6300		0.7000		1.0000		13.3061 (82)
West				1.2600	26.6072		0.6300		0.7000		1.0000		13.3061 (82)

Solar gains	469.8170	854.3660	1287.1421	1751.1963	2074.0320	2100.4809	2008.4331	1766.5770	1450.4962	978.5810	573.2021	394.9560	(83)
Total gains	1201.3723	1610.5150	2008.7624	2453.0994	2738.1287	2741.9765	2623.9960	2379.5897	2082.6885	1629.4571	1263.1241	1108.2529	(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	24.2157	24.2718	24.3270	24.5896	24.6394	24.8737	24.8737	24.9176	24.7829	24.6394	24.5389	24.4347		
alpha	2.6144	2.6181	2.6218	2.6393	2.6426	2.6582	2.6582	2.6612	2.6522	2.6426	2.6359	2.6290		
util living area	0.9802	0.9585	0.9184	0.8352	0.7135	0.5642	0.4368	0.4895	0.7028	0.8955	0.9663	0.9838	(86)	
MIT	18.0406	18.4832	19.1066	19.8574	20.4337	20.7880	20.9218	20.8927	20.5997	19.7767	18.7620	17.9712	(87)	
Th 2	19.8947	19.8970	19.8992	19.9096	19.9116	19.9207	19.9207	19.9224	19.9172	19.9116	19.9076	19.9035	(88)	
util rest of house	0.9768	0.9517	0.9049	0.8080	0.6664	0.4915	0.3420	0.3924	0.6369	0.8719	0.9596	0.9811	(89)	
MIT 2	17.1909	17.6291	18.2409	18.9658	19.4924	19.7949	19.8881	19.8743	19.6550	18.9092	17.9166	17.1275	(90)	
Living area fraction									fLA = Living area / (4) =			0.2269	(91)	
MIT	17.3837	17.8229	18.4373	19.1681	19.7060	20.0202	20.1227	20.1054	19.8694	19.1061	18.1084	17.3190	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.3837	17.8229	18.4373	19.1681	19.7060	20.0202	20.1227	20.1054	19.8694	19.1061	18.1084	17.3190	(93)	

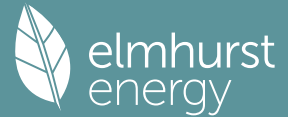
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9657	0.9341	0.8819	0.7863	0.6565	0.4987	0.3606	0.4099	0.6336	0.8499	0.9441	0.9714	(94)
Useful gains	1160.1078	1504.3811	1771.5918	1928.9460	1797.6003	1367.3785	946.1883	975.3288	1319.5825	1384.9270	1192.5344	1076.5715	(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	3793.7092	3738.4486	3445.4885	2932.0560	2281.4958	1530.0609	994.3996	1044.1459	1634.5816	2423.9944	3149.9386	3769.8518	(97)
Space heating kWh	1959.3994	1501.2934	1245.3791	722.2392	360.0182	0.0000	0.0000	0.0000	0.0000	773.0661	1409.3310	2003.8006	(98a)
Space heating requirement - total per year (kWh/year)												9974.5270	
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	1959.3994	1501.2934	1245.3791	722.2392	360.0182	0.0000	0.0000	0.0000	0.0000	773.0661	1409.3310	2003.8006	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9974.5270	
Space heating per m ²										(98c) / (4) =		42.3709	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7782	0.8370	0.8013	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2064.8269	1748.4667	1716.0342	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3078.4262	2946.0640	2669.4576	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	729.7915	891.0124	709.3470	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.4479	222.7531	177.3368	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												582.5377	(107)
Energy for space heating												42.3709	(99)
Energy for space cooling												2.4746	(108)
Total												44.8454	(109)
Fabric Energy Efficiency (TFEE)												44.8	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2597 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2597 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (22b)
Effective ac	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 25277.5000 (34)
107.3765 (35)

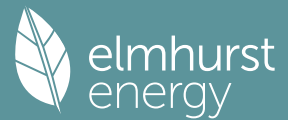
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	40.2200	0.0620	2.4936
E2 Other lintels (including other steel lintels)	40.2200	0.0390	1.5686
E3 Sill	65.3800	0.0520	3.3998
E4 Jamb	46.4800	0.0750	3.4860
E5 Ground floor (normal)	46.5100	0.0630	2.9301
E6 Intermediate floor within a dwelling	22.9200	0.0360	0.8251
E16 Corner (normal)	12.3600	0.0800	0.9888
R11 Upstands or kerbs of rooflights	15.7000	0.0510	0.8007
E13 Gable (insulation at rafter level)	6.5920	0.0400	0.2637
R5 Ridge (inverted)	5.1650	0.0600	0.3099
R8 Roof to wall (rafter)	4.7600	0.0410	0.1952
R1 Head of roof window	7.4210	0.0700	0.5195
E14 Flat roof	4.7600	0.0370	0.1761
R2 Sill of roof window	2.8600	0.0430	0.1230
R3 Jamb of roof window	22.3000	0.0080	0.1784
E11 Eaves (insulation at rafter level)	20.9000	-0.0200	-0.4180
R4 Ridge (vaulted ceiling)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.8404 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 169.8914 (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	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080 (38)

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Heat transfer coeff
292.6267 292.1559 291.6944 289.5269 289.1213 287.2335 287.2335 286.8839 287.9606 289.1213 289.9417 290.7994 (39)
Average = Sum(39)m / 12 = 289.5249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353	(40)
HLP (average)												1.2299	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3,0480 (42)

Hot water usage for mixer showers 75.3242 74.1922 72.5427 69.3867 67.0576 64.4602 62.9839 64.6209 66.4154 69.2042 72.4280 75.0356 (42a)

Hot water usage for baths 32.5151 32.0322 31.3522 30.0983 29.1595 28.1185 27.5561 28.2314 28.9666 30.0806 31.3602 32.4052 (42b)

Hot water usage for other uses 45.8442 44.1771 42.5101 40.8430 39.1759 37.5089 37.5089 39.1759 40.8430 42.5101 44.1771 45.8442 (42c)

Average daily hot water use (litres/day) 141.2695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	
Distribution loss (46)m = 0.15 x (45)m	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)
Water storage loss (or HIU loss):												200.0000	(47)
Store volume												1.4300	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.6000	(49)
Temperature factor from Table 2b												0.8580	(55)
Enter (49) or (54) in (55)													
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)
								Total per year (kWh/year) = Sum(64)m =				2995.4399	(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	127.1369	112.9471	121.0262	108.5907	106.8105	91.7876	91.3806	94.2449	94.4546	110.1851	114.8091	126.0098	(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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	170.8829	168.0761	162.6696	150.8205	143.5625	127.4827	122.8234	126.6733	131.1870	148.0982	159.4570	169.3679	(72)
Total internal gains	937.8496	936.0010	906.9928	853.3063	797.1854	738.3100	708.3894	711.2811	739.3964	798.1451	858.3668	911.0733	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1100	10.6334	0.6300	0.7000	0.7700	23.1054	(74)
East	21.7500	19.6403	0.6300	0.7000	0.7700	130.5505	(76)
South	19.3500	46.7521	0.6300	0.7000	0.7700	276.4736	(78)
West	27.3600	19.6403	0.6300	0.7000	0.7700	164.2235	(80)
East	1.6900	26.6072	0.6300	0.7000	1.0000	17.8471	(82)
West	1.6900	26.6072	0.6300	0.7000	1.0000	17.8471	(82)

Solar gains 630.0471 1145.7516 1726.1423 2348.4900 2781.4544 2816.9316 2693.4845 2369.1231 1945.2178 1312.3347 768.6926 529.6541 (83)

Total gains 1567.8966 2081.7526 2633.1351 3201.7962 3578.6397 3555.2416 3401.8739 3080.4042 2684.6143 2110.4798 1627.0594 1440.7274 (84)

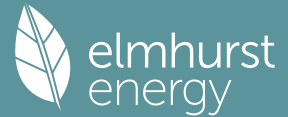
7. Mean internal temperature (heating season)

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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456	
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097	
util living area	0.9640	0.9294	0.8659	0.7552	0.6143	0.4686	0.3537	0.4008	0.6087	0.8367	0.9422	0.9705	(86)

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Living	18.8454	19.2104	19.7045	20.2254	20.5857	20.7788	20.8469	20.8320	20.6691	20.1306	19.3704	18.7731	
Non living	17.3664	17.8254	18.4376	19.0666	19.4744	19.6779	19.7358	19.7276	19.5794	18.9771	18.0392	17.2791	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	20	0	0	0	0	0	0	0	0	0	31	
16 / 9	0	8	31	11	0	0	0	0	0	0	30	0	
MIT	21.0000	20.7104	20.2663	20.3485	20.5857	20.7788	20.8469	20.8320	20.6691	20.1306	20.0771	21.0000 (87)	
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)	
util rest of house	0.9582	0.9186	0.8462	0.7215	0.5642	0.4009	0.2719	0.3147	0.5399	0.8045	0.9314	0.9657 (89)	
MIT 2	19.8857	19.6273	19.2483	19.2365	19.4744	19.6779	19.7358	19.7276	19.5794	18.9771	19.0758	19.8919 (90)	
Living area fraction	20.1386	19.8731	19.4793	19.4889	19.7266	19.9277	19.9879	19.9782	fLA = Living area / (4) =				0.2269 (91)
MIT	20.1386	19.8731	19.4793	19.4889	19.7266	19.9277	19.9879	19.9782	19.8267	19.2389	19.3030	20.1433 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.1386	19.8731	19.4793	19.4889	19.7266	19.9277	19.9879	19.9782	19.8267	19.2389	19.3030	20.1433 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9596	0.9185	0.8380	0.7076	0.5558	0.4024	0.2784	0.3207	0.5348	0.7815	0.9246	0.9669	(94)
Useful gains	1504.6317	1912.0600	2206.5459	2265.6818	1989.1559	1430.6426	946.9901	987.8455	1435.6581	1649.3798	1504.3480	1393.0037	(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	4634.7889	4374.4707	3785.9883	3065.7647	2320.6608	1530.2893	973.1178	1026.5272	1649.0714	2497.6858	3538.1514	4636.3120	(97)
Space heating kWh	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214	(98a)
Space heating requirement - total per year (kWh/year)												10489.8782	
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	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10489.8782	
Space heating per m2										(98c) / (4) =		44.5600	(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 %)													205.0538 (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	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214	(98)
Space heating efficiency (main heating system 1)	205.0538	205.0538	205.0538	205.0538	205.0538	0.0000	0.0000	0.0000	0.0000	205.0538	205.0538	205.0538	(210)
Space heating fuel (main heating system)	1135.7200	806.9772	573.0716	280.9310	120.2805	0.0000	0.0000	0.0000	0.0000	307.7923	714.1241	1176.7748	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)
Efficiency of water heater (217)m	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	(216)
Fuel for water heating, kWh/month	174.1848	154.0472	163.5551	143.4388	138.8268	120.4258	118.4099	123.3924	125.0652	144.6970	154.2556	172.2241	(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	41.4299	33.2366	29.9259	21.9250	16.9355	13.8364	15.4491	20.0813	26.0837	34.2232	38.6550	42.5813	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-57.5848	-87.3315	-141.6772	-182.8103	-208.7908	-183.5451	-178.2841	-156.9925	-122.9506	-99.6384	-64.1892	-49.5395	(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												5115.6715	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.8947	
Water heating fuel used												1732.5229	(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)												334.3629	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1533.3340	(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												5649.2233	(238)

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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5115.6715	16.4900	843.5742	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1732.5229	16.4900	285.6930	(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	334.3629	16.4900	55.1364	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1533.3340	16.4900	-252.8468	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-252.8468	(252)
Total energy cost			931.5569	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1960	(257)
SAP value		80.6134	
SAP rating (Section 12)		81	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5115.6715	0.1563	799.4756	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1732.5229	0.1412	244.6169	(264)
Space and water heating			1044.0925	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	334.3629	0.1443	48.2589	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1533.3340	0.1333	-204.4546	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-204.4546	(269)
Total CO2, kg/year			887.8968	(272)
CO2 emissions per m2			3.7700	(273)
EI value			95.7570	
EI rating			96	(274)
EI band			A	

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

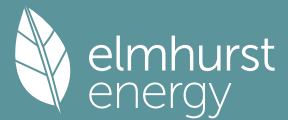
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800	(1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694	(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	(8)
Pressure test		0.0597	
Pressure Test Method		Yes	
Measured/design AP50		Blower Door	
Infiltration rate		4.0000	(17)
Number of sides sheltered		0.2597	(18)
		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2597	(21)

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Wind speed	Jan 4.4000	Feb 4.3000	Mar 4.3000	Apr 3.8000	May 3.8000	Jun 3.3000	Jul 3.3000	Aug 3.4000	Sep 3.4000	Oct 3.7000	Nov 3.8000	Dec 4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000	(22a)
Adj infilt rate													
Effective ac	0.2856	0.2791	0.2791	0.2467	0.2467	0.2142	0.2142	0.2207	0.2207	0.2402	0.2467	0.2597	(22b)
	0.5408	0.5390	0.5390	0.5304	0.5304	0.5229	0.5229	0.5244	0.5244	0.5288	0.5304	0.5337	(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								
Windows			75.5700	1.1450	86.5305			(27)
Rooflights			3.3800	1.3258	4.4811			(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000	(28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400	(29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400	(29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800	(29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600	(29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300	(30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100	(30)
Total net area of external elements Aum(A, m2)			536.2500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...	(30) + (32) =	152.0510		(33)
Main dwelling								
GF			169.3300			9.0000	1523.9700	(32c)
1ST MASTER			37.7600			9.0000	339.8400	(32c)
1ST BEDROOM			107.2800			9.0000	965.5200	(32c)
1ST LAND			148.6600			9.0000	1337.9400	(32c)
FF			113.4100			18.0000	2041.3800	(32d)
GF			113.4100			9.0000	1020.6900	(32e)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 25277.5000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8404 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 169.8914 (37)

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

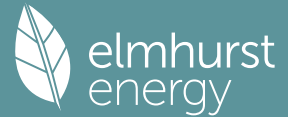
(38)m	Jan 119.6354	Feb 119.2299	Mar 119.2299	Apr 117.3420	May 117.3420	Jun 115.6872	Jul 115.6872	Aug 115.9995	Sep 115.9995	Oct 116.9924	Nov 117.3420	Dec 118.0692	(38)
Heat transfer coeff	289.5269	289.1213	289.1213	287.2335	287.2335	285.5787	285.5787	285.8910	285.8910	286.8839	287.2335	287.9606	(39)
Average = Sum(39)m / 12 =												287.2711	

HLP	Jan 1.2299	Feb 1.2282	Mar 1.2282	Apr 1.2201	May 1.2201	Jun 1.2131	Jul 1.2131	Aug 1.2144	Sep 1.2144	Oct 1.2187	Nov 1.2201	Dec 1.2232	(40)
HLP (average)												1.2203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480	(42)
Hot water usage for mixer showers														
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)		
Hot water usage for baths														
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)		
Hot water usage for other uses														
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)		
Average daily hot water use (litres/day)													141.2695	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)		
Energy content (annual)	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2346.4575		
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)		
Water storage loss (or HIU loss):														
Store volume												200.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.4300	(48)	
Temperature factor from Table 2b												0.6000	(49)	
Enter (49) or (54) in (55)												0.8580	(55)	
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)	
If cylinder contains dedicated solar storage														
26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)		
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)	
										Total per year (kWh/year) = Sum(64)m =		2995.4399	(64)	

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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	127.1369	112.9471	121.0262	108.5907	106.8105	91.7876	91.3806	94.2449	94.4546	110.1851	114.8091	126.0098 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	170.8829	168.0761	162.6696	150.8205	143.5625	127.4827	122.8234	126.6733	131.1870	148.0982	159.4570	169.3679	(72)
Total internal gains	937.8496	936.0010	906.9928	853.3063	797.1854	738.3100	708.3894	711.2811	739.3964	798.1451	858.3668	911.0733	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				7.1100	12.0539	0.6300	0.7000		0.7700		26.1920 (74)	
East				21.7500	22.4175	0.6300	0.7000		0.7700		149.0108 (76)	
South				19.3500	51.7504	0.6300	0.7000		0.7700		306.0318 (78)	
West				27.3600	22.4175	0.6300	0.7000		0.7700		187.4453 (80)	
East				1.6900	30.5425	0.6300	0.7000		1.0000		20.4867 (82)	
West				1.6900	30.5425	0.6300	0.7000		1.0000		20.4867 (82)	
Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271	590.7272 (83)
Total gains	1647.5028	2139.1940	2689.0794	3324.0183	3652.0104	3770.3290	3576.1431	3245.9093	2834.9404	2238.4570	1745.4939	1501.8006 (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	24.2517	24.2857	24.2857	24.4454	24.4454	24.5870	24.5870	24.5602	24.5602	24.4752	24.4454	24.3836	
alpha	2.6168	2.6190	2.6190	2.6297	2.6297	2.6391	2.6391	2.6373	2.6373	2.6317	2.6297	2.6256	
util living area	0.9587	0.9231	0.8529	0.7254	0.5777	0.4037	0.2798	0.3064	0.5423	0.8013	0.9297	0.9667	(86)
Living	18.9452	19.2930	19.8019	20.3238	20.6471	20.8195	20.8672	20.8629	20.7407	20.2646	19.4953	18.8620	
Non living	17.4995	17.9357	18.5632	19.1864	19.5449	19.7181	19.7542	19.7513	19.6538	19.1398	18.2013	17.3982	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	18	0	0	0	0	0	0	0	0	0	31	
16 / 9	0	10	31	10	0	0	0	0	0	0	30	0	
MIT	21.0000	20.6547	20.3214	20.4215	20.6471	20.8195	20.8672	20.8629	20.7407	20.2646	20.1478	21.0000	(87)
Th 2	19.8962	19.8975	19.8975	19.9039	19.9039	19.9095	19.9095	19.9085	19.9085	19.9051	19.9039	19.9015	(88)
util rest of house	0.9521	0.9114	0.8314	0.6885	0.5245	0.3347	0.1981	0.2177	0.4675	0.7630	0.9169	0.9613	(89)
MIT 2	19.8962	19.5883	19.3086	19.3200	19.5449	19.7181	19.7542	19.7513	19.6538	19.1398	19.1524	19.9015	(90)
Living area fraction	20.1467	19.8303	19.5384	19.5700	19.7950	19.9680	20.0068	20.0036	19.9005	19.3950	19.3783	20.1507	(91)
MIT	20.1467	19.8303	19.5384	19.5700	19.7950	19.9680	20.0068	20.0036	19.9005	19.3950	19.3783	20.1507	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1467	19.8303	19.5384	19.5700	19.7950	19.9680	20.0068	20.0036	19.9005	19.3950	19.3783	20.1507	(93)

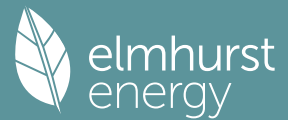
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9106	0.8235	0.6762	0.5188	0.3385	0.2055	0.2257	0.4669	0.7422	0.9096	0.9626	(94)
Useful gains	1571.2364	1947.9756	2214.5535	2247.8044	1894.7487	1276.3643	735.0380	732.4821	1323.5400	1661.3264	1587.6831	1445.6183	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	4530.1264	4258.8400	3654.0399	2921.1522	2152.8142	1333.0853	744.4374	744.3383	1458.1730	2351.0171	3440.5634	4535.5945	(97)
Space heating kWh	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	(98a)
Space heating requirement - total per year (kWh/year)												9648.2501	
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	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9648.2501	
Space heating per m ²										(98c) / (4) =		40.9849	(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 %)													205.1945 (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		

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Space heating requirement	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	(98)
Space heating efficiency (main heating system 1)	205.1945	205.1945	205.1945	205.1945	205.1945	0.0000	0.0000	0.0000	0.0000	205.1945	205.1945	205.1945	(210)
Space heating fuel (main heating system)	1072.8425	756.7944	521.9329	236.2687	93.5701	0.0000	0.0000	0.0000	0.0000	250.0699	650.1507	1120.3720	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)
Efficiency of water heater	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	(216)
Fuel for water heating, kWh/month	174.1858	154.0481	163.5561	143.4396	138.8276	120.4265	118.4106	123.3931	125.0659	144.6978	154.2565	172.2251	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	41.4299	33.2366	29.9259	21.9250	16.9355	13.8364	15.4491	20.0813	26.0837	34.2232	38.6550	42.5813	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.7337	-91.1658	-146.2337	-188.9496	-210.6522	-191.5192	-185.3690	-164.8881	-130.7146	-106.5506	-72.2353	-54.3226	(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												4702.0012	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												172.8937	
Water heating fuel used												1732.5327	(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)												334.3629	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1606.3342	(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												5162.5626	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4702.0012	28.4300	1336.7789 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1732.5327	28.4300	492.5591 (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	334.3629	28.4300	95.0594 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	28.4300	-456.6808
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-456.6808 (252)
Total energy cost			1467.7166 (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	4702.0012	0.1567	736.7567 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1732.5327	0.1412	244.6183 (264)
Space and water heating			981.3751 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3629	0.1443	48.2589 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	0.1335	-214.4006
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-214.4006 (269)
Total CO2, kg/year			815.2333 (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	4702.0012	1.5801	7429.4044 (275)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1732.5327	1.5221	2637.0742 (278)
Space and water heating			10066.4785 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	334.3629	1.5338	512.8570 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	1.4932	-2398.6253
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2398.6253 (283)
Total Primary energy kWh/year			8180.7102 (286)

SAP 10 EPC IMPROVEMENTS

BE GREEN main dwelling

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

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 1.0	-£ 87	-38 kg (4.7%)
-----------------------	-------	-------	---------------

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

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

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
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	£1924	£1924	£0
Space heating	£1337	£1337	£0
Water heating	£493	£493	£0
Lighting	£95	£95	£0
Generated (PV)	-£457	-£457	£0
Total cost of fuels	£1467	£1467	£0
Total cost of uses	£1468	£1468	£0
Delivered energy	22 kWh/m²	22 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	35 kWh/m²	35 kWh/m²	0 kWh/m²

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

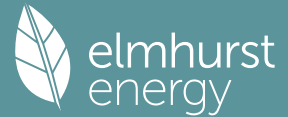
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling			
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 670.3694 (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)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.0597 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50 4.0000 (17)
Infiltration rate 0.2597 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = $1 - [0.075 \times (19)] = 1.0000$ (20)
Infiltration rate adjusted to include shelter factor (21) = $(18) \times (20) = 0.2597$ (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3311	0.3246	0.3181	0.2856	0.2791	0.2467	0.2467	0.2402	0.2597	0.2791	0.2921	0.3051 (22b)
	0.5548	0.5527	0.5506	0.5408	0.5390	0.5304	0.5304	0.5288	0.5337	0.5390	0.5427	0.5465 (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							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m2)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301
E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8404 (36)
Point Thermal bridges 0.0000 (36a) =
Total fabric heat loss (33) + (36) + (36a) = 169.8914 (37)

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

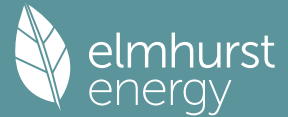
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	122.7353	122.2645	121.8030	119.6354	119.2299	117.3420	117.3420	116.9924	118.0692	119.2299	120.0503	120.9080 (38)
Heat transfer coeff	292.6267	292.1559	291.6944	289.5269	289.1213	287.2335	287.2335	286.8839	287.9606	289.1213	289.9417	290.7994 (39)
Average = Sum(39)m / 12 =												289.5249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2431	1.2411	1.2391	1.2299	1.2282	1.2201	1.2201	1.2187	1.2232	1.2282	1.2316	1.2353 (40)
HLP (average)												1.2299
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0480 (42)
Hot water usage for mixer showers												
75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356 (42a)	
Hot water usage for baths												
32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052 (42b)	
Hot water usage for other uses												
45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442 (42c)	
Average daily hot water use (litres/day)												141.2695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850 (44)	
Energy content (annual)	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2346.4575
36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011 (46)	
Water storage loss (or HIU loss):												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4300 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8580 (55)
Total storage loss												
26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980 (56)	
If cylinder contains dedicated solar storage												
26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980 (57)	
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	22.5120	31.1612	30.1560	31.1612 (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												

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WWHRS	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664 (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	127.1369	112.9471	121.0262	108.5907	106.8105	91.7876	91.3806	94.2449	94.4546	110.1851	114.8091	126.0098 (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	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357 (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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185 (71)
Water heating gains (Table 5)	170.8829	168.0761	162.6696	150.8205	143.5625	127.4827	122.8234	126.6733	131.1870	148.0982	159.4570	169.3679 (72)
Total internal gains	937.8496	936.0010	906.9928	853.3063	797.1854	738.3100	708.3894	711.2811	739.3964	798.1451	858.3668	911.0733 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North						7.1100	10.6334	0.6300	0.7000	0.7700	23.1054 (74)	
East						21.7500	19.6403	0.6300	0.7000	0.7700	130.5505 (76)	
South						19.3500	46.7521	0.6300	0.7000	0.7700	276.4736 (78)	
West						27.3600	19.6403	0.6300	0.7000	0.7700	164.2235 (80)	
East						1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)	
West						1.6900	26.6072	0.6300	0.7000	1.0000	17.8471 (82)	
Solar gains	630.0471	1145.7516	1726.1423	2348.4900	2781.4544	2816.9316	2693.4845	2369.1231	1945.2178	1312.3347	768.6926	529.6541 (83)
Total gains	1567.8966	2081.7526	2633.1351	3201.7962	3578.6397	3555.2416	3401.8739	3080.4042	2684.6143	2110.4798	1627.0594	1440.7274 (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	23.9948	24.0335	24.0715	24.2517	24.2857	24.4454	24.4454	24.4752	24.3836	24.2857	24.2170	24.1456
alpha	2.5997	2.6022	2.6048	2.6168	2.6190	2.6297	2.6297	2.6317	2.6256	2.6190	2.6145	2.6097
util living area	0.9640	0.9294	0.8659	0.7552	0.6143	0.4686	0.3537	0.4008	0.6087	0.8367	0.9422	0.9705 (86)
Living	18.8454	19.2104	19.7045	20.2254	20.5857	20.7788	20.8469	20.8320	20.6691	20.1306	19.3704	18.7731
Non living	17.3664	17.8254	18.4376	19.0666	19.4744	19.6779	19.7358	19.7276	19.5794	18.9771	18.0392	17.2791
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	20	0	0	0	0	0	0	0	0	0	31
16 / 9	0	8	31	11	0	0	0	0	0	0	30	0
MIT	21.0000	20.7104	20.2663	20.3485	20.5857	20.7788	20.8469	20.8320	20.6691	20.1306	20.0771	21.0000 (87)
Th 2	19.8857	19.8873	19.8889	19.8962	19.8975	19.9039	19.9039	19.9051	19.9015	19.8975	19.8948	19.8919 (88)
util rest of house	0.9582	0.9186	0.8462	0.7215	0.5642	0.4009	0.2719	0.3147	0.5399	0.8045	0.9314	0.9657 (89)
MIT 2	19.8857	19.6273	19.2483	19.2365	19.4744	19.6779	19.7358	19.7276	19.5794	18.9771	19.0758	19.8919 (90)
Living area fraction												0.2269 (91)
MIT	20.1386	19.8731	19.4793	19.4889	19.7266	19.9277	19.9879	19.9782	19.8267	19.2389	19.3030	20.1433 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1386	19.8731	19.4793	19.4889	19.7266	19.9277	19.9879	19.9782	19.8267	19.2389	19.3030	20.1433 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1504.6317	1912.0640	2206.5459	2265.6818	1989.1559	1430.6426	946.9901	987.8455	1435.6581	1649.3798	1504.3480	1393.0037 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	4634.7889	4374.4707	3785.9883	3065.7647	2320.6608	1530.2893	973.1178	1026.5272	1649.0714	2497.6858	3538.1514	4636.3120 (97)
Space heating kWh	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214 (98a)
Space heating requirement - total per year (kWh/year)												10489.8782
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	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10489.8782
Space heating per m2										(98c) / (4) =		44.5600 (99)

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

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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 %)													205.0538 (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	2328.8369	1654.7373	1175.1051	576.0597	246.6397	0.0000	0.0000	0.0000	0.0000	631.1397	1464.3384	2413.0214	(98)
Space heating efficiency (main heating system 1)	205.0538	205.0538	205.0538	205.0538	205.0538	0.0000	0.0000	0.0000	0.0000	205.0538	205.0538	205.0538	(210)
Space heating fuel (main heating system)	1135.7200	806.9772	573.0716	280.9310	120.2805	0.0000	0.0000	0.0000	0.0000	307.7923	714.1241	1176.7748	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(64)
Efficiency of water heater	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	172.8947	(216)
Fuel for water heating, kWh/month	174.1848	154.0472	163.5551	143.4388	138.8268	120.4258	118.4099	123.3924	125.0652	144.6970	154.2556	172.2241	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	41.4299	33.2366	29.9259	21.9250	16.9355	13.8364	15.4491	20.0813	26.0837	34.2232	38.6550	42.5813	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-57.5848	-87.3315	-141.6772	-182.8103	-208.7908	-183.5451	-178.2841	-156.9925	-122.9506	-99.6384	-64.1892	-49.5395	(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													5115.6715 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													172.8947
Water heating fuel used													1732.5229 (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)													334.3629 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation													-1533.3340 (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													5649.2233 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5115.6715	16.4900	843.5742	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1732.5229	16.4900	285.6930	(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	334.3629	16.4900	55.1364	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1533.3340	16.4900	-252.8468	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-252.8468	(252)
Total energy cost			931.5569	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1960	(257)
SAP value		80.6134	
SAP rating (Section 12)		81	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5115.6715	0.1563	799.4756	(261)
Total CO2 associated with community systems			0.0000	(373)

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Water heating (other fuel)	1732.5229	0.1412	244.6169 (264)
Space and water heating			1044.0925 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3629	0.1443	48.2589 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1533.3340	0.1333	-204.4546
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-204.4546 (269)
Total CO ₂ , kg/year			887.8968 (272)
CO ₂ emissions per m ²			3.7700 (273)
EI value			95.7570
EI rating			96 (274)
EI band			A

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	122.0000 (1b)	x 2.3900 (2b)	= 291.5800 (1b) - (3b)
First floor	113.4100 (1c)	x 3.3400 (2c)	= 378.7894 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	670.3694 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0597 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2597	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2597	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.2856	0.2791	0.2791	0.2467	0.2467	0.2142	0.2142	0.2207	0.2207	0.2402	0.2467	0.2597 (22b)
Effective ac	0.5408	0.5390	0.5390	0.5304	0.5304	0.5229	0.5229	0.5244	0.5244	0.5288	0.5304	0.5337 (25)

3. Heat losses and heat loss parameter

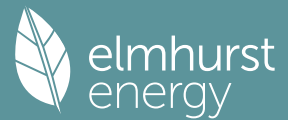
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			75.5700	1.1450	86.5305		(27)
Rooflights			3.3800	1.3258	4.4811		(27a)
GF			122.0000	0.1100	13.4200	110.0000	13420.0000 (28a)
GF EXT WALLS	111.1800	47.6500	63.5300	0.1700	10.8001	18.0000	1143.5400 (29a)
1ST EXT WALLS master	43.9600	8.8300	35.1300	0.1700	5.9721	18.0000	632.3400 (29a)
1ST EXT WALL BEDROOM	71.4900	9.0800	62.4100	0.1700	10.6097	18.0000	1123.3800 (29a)
1ST EXT LAND	27.8800	10.0100	17.8700	0.1700	3.0379	18.0000	321.6600 (29a)
MAIN ROOF	147.0500	3.3800	143.6700	0.1100	15.8037	9.0000	1293.0300 (30)
FLAT ROOF	12.6900		12.6900	0.1100	1.3959	9.0000	114.2100 (30)
Total net area of external elements Aum(A, m ²)			536.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	152.0510		(33)
Main dwelling							
GF			169.3300			9.0000	1523.9700 (32c)
1ST MASTER			37.7600			9.0000	339.8400 (32c)
1ST BEDROOM			107.2800			9.0000	965.5200 (32c)
1ST LAND			148.6600			9.0000	1337.9400 (32c)
FF			113.4100			18.0000	2041.3800 (32d)
GF			113.4100			9.0000	1020.6900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25277.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		107.3765 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	40.2200	0.0620	2.4936
E3 Sill	40.2200	0.0390	1.5686
E4 Jamb	65.3800	0.0520	3.3998
E5 Ground floor (normal)	46.4800	0.0750	3.4860
E6 Intermediate floor within a dwelling	46.5100	0.0630	2.9301

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E16 Corner (normal)	22.9200	0.0360	0.8251
R11 Upstands or kerbs of rooflights	12.3600	0.0800	0.9888
E13 Gable (insulation at rafter level)	15.7000	0.0510	0.8007
R5 Ridge (inverted)	6.5920	0.0400	0.2637
R8 Roof to wall (rafter)	5.1650	0.0600	0.3099
R1 Head of roof window	4.7600	0.0410	0.1952
E14 Flat roof	7.4210	0.0700	0.5195
R2 Sill of roof window	4.7600	0.0370	0.1761
R3 Jamb of roof window	2.8600	0.0430	0.1230
E11 Eaves (insulation at rafter level)	22.3000	0.0080	0.1784
R4 Ridge (vaulted ceiling)	20.9000	-0.0200	-0.4180
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.8404 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	169.8914 (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	119.6354	119.2299	119.2299	117.3420	117.3420	115.6872	115.6872	115.9995	115.9995	116.9924	117.3420	118.0692	(38)
Heat transfer coeff	289.5269	289.1213	289.1213	287.2335	287.2335	285.5787	285.5787	285.8910	285.8910	286.8839	287.2335	287.9606	(39)
Average = Sum(39)m / 12 =												287.2711	
HLP	1.2299	1.2282	1.2282	1.2201	1.2201	1.2131	1.2131	1.2144	1.2144	1.2187	1.2201	1.2232	(40)
HLP (average)												1.2203	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0480 (42)
Hot water usage for mixer showers	75.3242	74.1922	72.5427	69.3867	67.0576	64.4602	62.9839	64.6209	66.4154	69.2042	72.4280	75.0356	(42a)
Hot water usage for baths	32.5151	32.0322	31.3522	30.0983	29.1595	28.1185	27.5561	28.2314	28.9666	30.0806	31.3602	32.4052	(42b)
Hot water usage for other uses	45.8442	44.1771	42.5101	40.8430	39.1759	37.5089	37.5089	39.1759	40.8430	42.5101	44.1771	45.8442	(42c)
Average daily hot water use (litres/day)												141.2695	(43)
Daily hot water use	153.6835	150.4015	146.4049	140.3280	135.3930	130.0876	128.0489	132.0282	136.2250	141.7948	147.9654	153.2850	(44)
Energy conte	243.3971	214.1698	225.0190	192.1020	182.2650	159.9578	154.8640	163.4785	167.9791	192.4142	210.8038	240.0072	(45)
Energy content (annual)										Total = Sum(45)m =		2346.4575	
Distribution loss (46)m = 0.15 x (45)m	36.5096	32.1255	33.7528	28.8153	27.3398	23.9937	23.2296	24.5218	25.1969	28.8621	31.6206	36.0011	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4300	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.8580	(55)
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	(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	127.1369	112.9471	121.0262	108.5907	106.8105	91.7876	91.3806	94.2449	94.4546	110.1851	114.8091	126.0098	(65)

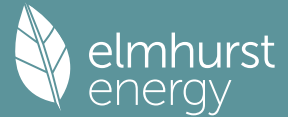
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	182.8778	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.3392	608.5896	592.8388	559.3072	516.9796	477.1976	450.6208	444.3704	460.1212	493.6528	535.9804	575.7624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	56.3357	(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)	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	-121.9185	(71)
Water heating gains (Table 5)	170.8829	168.0761	162.6696	150.8205	143.5625	127.4827	122.8234	126.6733	131.1870	148.0982	159.4570	169.3679	(72)
Total internal gains	937.8496	936.0010	906.9928	853.3063	797.1854	738.3100	708.3894	711.2811	739.3964	798.1451	858.3668	911.0733	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.1100	12.0539	0.6300	0.7000	0.7700	26.1920 (74)
East	21.7500	22.4175	0.6300	0.7000	0.7700	149.0108 (76)
South	19.3500	51.7504	0.6300	0.7000	0.7700	306.0318 (78)
West	27.3600	22.4175	0.6300	0.7000	0.7700	187.4453 (80)
East	1.6900	30.5425	0.6300	0.7000	1.0000	20.4867 (82)

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West		1.6900			30.5425			0.6300			0.7000			1.0000			20.4867 (82)		
Solar gains	709.6533	1203.1930	1782.0866	2470.7120	2854.8250	3032.0189	2867.7537	2534.6282	2095.5439	1440.3119	887.1271	590.7272	(83)						
Total gains	1647.5028	2139.1940	2689.0794	3324.0183	3652.0104	3770.3290	3576.1431	3245.9093	2834.9404	2238.4570	1745.4939	1501.8006	(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	24.2517	24.2857	24.2857	24.4454	24.4454	24.5870	24.5870	24.5602	24.5602	24.4752	24.4454	24.3836	
alpha	2.6168	2.6190	2.6190	2.6297	2.6297	2.6391	2.6391	2.6373	2.6373	2.6317	2.6297	2.6256	
util living area	0.9587	0.9231	0.8529	0.7254	0.5777	0.4037	0.2798	0.3064	0.5423	0.8013	0.9297	0.9667	86
Living	18.9452	19.2930	19.8019	20.3238	20.6471	20.8195	20.8672	20.8629	20.7407	20.2646	19.4953	18.8620	
Non living	17.4995	17.9357	18.5632	19.1864	19.5449	19.7181	19.7542	19.7513	19.6538	19.1398	18.2013	17.3982	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	18	0	0	0	0	0	0	0	0	0	31	
16 / 9	0	10	31	10	0	0	0	0	0	0	30	0	
MIT	21.0000	20.6547	20.3214	20.4215	20.6471	20.8195	20.8672	20.8629	20.7407	20.2646	20.1478	21.0000	87
Th 2	19.8962	19.8975	19.8975	19.9039	19.9039	19.9095	19.9095	19.9085	19.9085	19.9051	19.9039	19.9015	88
util rest of house	0.9521	0.9114	0.8314	0.6885	0.5245	0.3347	0.1981	0.2177	0.4675	0.7630	0.9169	0.9613	89
MIT 2	19.8962	19.5883	19.3086	19.3200	19.5449	19.7181	19.7542	19.7513	19.6538	19.1398	19.1524	19.9015	90
Living area fraction													
MIT	20.1467	19.8303	19.5384	19.5700	19.7950	19.9680	20.0068	20.0036	19.9005	19.3950	19.3783	20.1507	92
Temperature adjustment												0.0000	
adjusted MIT	20.1467	19.8303	19.5384	19.5700	19.7950	19.9680	20.0068	20.0036	19.9005	19.3950	19.3783	20.1507	93

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9537	0.9106	0.8235	0.6762	0.5188	0.3385	0.2055	0.2257	0.4669	0.7422	0.9096	0.9626	94
Useful gains	1571.2364	1947.9756	2214.5535	2247.8044	1894.7487	1276.3643	735.0380	732.4821	1323.5400	1661.3264	1587.6831	1445.6183	95
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	96
Heat loss rate W	4530.1264	4258.8400	3654.0399	2921.1522	2152.8142	1333.0853	744.4374	744.3383	1458.1730	2351.0171	3440.5634	4535.5945	97
Space heating kWh	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	98a
Space heating requirement - total per year (kWh/year)												9648.2501	
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	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	98c
Space heating requirement after solar contribution - total per year (kWh/year)												9648.2501	
Space heating per m2										(98c) / (4) =		40.9849	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 %)													205.1945 (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	2201.4142	1552.9009	1070.9779	484.8104	192.0007	0.0000	0.0000	0.0000	0.0000	513.1299	1334.0738	2298.9423	98
Space heating efficiency (main heating system 1)	205.1945	205.1945	205.1945	205.1945	205.1945	0.0000	0.0000	0.0000	0.0000	205.1945	205.1945	205.1945	210
Space heating fuel (main heating system)	1072.8425	756.7944	521.9329	236.2687	93.5701	0.0000	0.0000	0.0000	0.0000	250.0699	650.1507	1120.3720	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	301.1563	266.3394	282.7782	247.9980	240.0242	208.2098	204.7244	213.3389	216.2311	250.1734	266.6998	297.7664	64
Efficiency of water heater (217)m	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	172.8937	216
Fuel for water heating, kWh/month	174.1858	154.0481	163.5561	143.4396	138.8276	120.4265	118.4106	123.3931	125.0659	144.6978	154.2565	172.2251	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	41.4299	33.2366	29.9259	21.9250	16.9355	13.8364	15.4491	20.0813	26.0837	34.2232	38.6550	42.5813	232
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-63.7337	-91.1658	-146.2337	-188.9496	-210.6522	-191.5192	-185.3690	-164.8881	-130.7146	-106.5506	-72.2353	-54.3226	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												4702.0012	211
Space heating fuel - main system 2												0.0000	213

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	172.8937
Water heating fuel used	1732.5327 (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)	334.3629 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1606.3342 (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	5162.5626 (238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4702.0012	28.4300	1336.7789 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1732.5327	28.4300	492.5591 (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	334.3629	28.4300	95.0594 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	28.4300	-456.6808
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-456.6808 (252)
Total energy cost			1467.7166 (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	4702.0012	0.1567	736.7567 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1732.5327	0.1412	244.6183 (264)
Space and water heating			981.3751 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	334.3629	0.1443	48.2589 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	0.1335	-214.4006
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-214.4006 (269)
Total CO2, kg/year			815.2333 (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	4702.0012	1.5801	7429.4044 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1732.5327	1.5221	2637.0742 (278)
Space and water heating			10066.4785 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	334.3629	1.5338	512.8570 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1606.3342	1.4932	-2398.6253
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2398.6253 (283)
Total Primary energy kWh/year			8180.7102 (286)

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Plot Reference	BASE/BELEAN/BEGREEN			Issued on Date	27/01/2026
Assessment Reference	BE GREEN annex dwelling	Plot Type Ref	Flint House		
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD			SAP Version	10.2
SAP Rating	85 B	DER	4.80	TER	13.14
Environmental	97 A	% DER < TER			63.47
CO ₂ Emissions (t/year)	0.21	DFEE	49.42	TFEE	53.13
Compliance Check	See BREL	% DFEE < TFEE			6.97
% DPER < TPER	29.88	DPER	49.22	TPER	70.19
Assessor Details	Mr. Neil Bradford			Assessor ID	T704-0001
Client	Flint House, Joe Reader				

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	48.9300 (1b)	3.1400 (2b)	153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402 (4)
Dwelling volume			153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) =	0.1302 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3802	(18)
Number of sides sheltered	1	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (25)

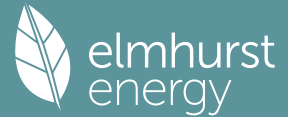
3. Heat losses and heat loss parameter

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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	10652.6799 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		217.7126 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	5.7700	0.0620	0.3577
E2 Other lintels (including other steel lintels)	5.7700	0.0390	0.2250
E3 Sill	9.6400	0.0520	0.5013
E4 Jamb	22.8400	0.0750	1.7130
E5 Ground floor (normal)	6.2500	0.0360	0.2250
E16 Corner (normal)	6.2800	0.0990	0.6217
E18 Party wall between dwellings	5.7170	0.0800	0.4574
P1 Party wall - Ground floor			

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P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104
E13 Gable (insulation at rafter level)	17.1400	0.0510	0.8741
E11 Eaves (insulation at rafter level)	6.4000	0.0080	0.0512
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.5655 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	40.7218 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	30.4470	30.2491	30.0551
Average = Sum(39)m / 12 =	71.1688	70.9709	70.7769
	Apr	May	Jun
	29.1440	28.9735	28.1800
	68.9018	68.9018	68.7548
	69.6953	69.6953	69.2074
	70.4002	70.4002	70.4002
	70.4007 (39)	70.4007 (39)	70.4007 (39)
	69.8650	69.8650	69.8650
	Jan	Feb	Mar
HLP	1.4545	1.4505	1.4465
HLP (average)			
Days in mont	31	28	31
	Apr	May	Jun
	1.4279	1.4244	1.4082
	31	31	31
	1.4082	1.4052	1.4144
	31	31	31
	1.4244	1.4314	1.4388 (40)
	31	31	1.4279
	31	31	31

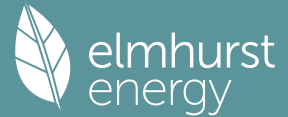
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.6586 (42)
Hot water usage for mixer showers												66.5147 (42a)
Hot water usage for baths												0.0000 (42b)
Hot water usage for other uses												31.6162 (42c)
Average daily hot water use (litres/day)												90.3022 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474 (46)
Water storage loss (or HIU loss):												80.0000 (47)
Store volume												1.0000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.6000 (49)
Temperature factor from Table 2b												0.6000 (55)
Enter (49) or (54) in (55)												0.6000 (55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (56)
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000 (57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
12Total per year (kWh/year)												2054.8515 (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	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973 (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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains	388.5738	396.0708	380.9650	367.7439	350.4816	330.0032	318.2156	319.2072	328.3377	347.8530	367.7441	381.2297 (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							
South	6.8900	46.7521	0.6300	0.7000	0.7700	98.4446 (78)						
West	3.3200	19.6403	0.6300	0.7000	0.7700	19.9277 (80)						
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	506.9461	596.2805	650.5385	693.4922	707.1105	680.2455	657.4847	636.1423	617.5418	568.0077	509.2820	482.6825 (84)

7. Mean internal temperature (heating season)

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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	41.5783	41.6943	41.8085	42.3537	42.4573	42.9463	42.9463	43.0381	42.7566	42.4573	42.2483	42.0319
alpha	3.7719	3.7796	3.7872	3.8236	3.8305	3.8631	3.8631	3.8692	3.8504	3.8305	3.8166	3.8021
util living area	0.9765	0.9572	0.9266	0.8631	0.7571	0.5996	0.4483	0.4799	0.6819	0.8771	0.9579	0.9801 (86)
Living	19.7230	19.9320	20.1876	20.4917	20.7240	20.8626	20.9055	20.9011	20.8218	20.5266	20.0784	19.6921
Non living	18.2771	18.5396	18.8563	19.2282	19.4838	19.6224	19.6500	19.6505	19.5876	19.2799	18.7378	18.2473
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	20.3468	19.9320	20.1876	20.4917	20.7240	20.8626	20.9055	20.9011	20.8218	20.5266	20.0784	19.8751 (87)
Th 2	19.7218	19.7249	19.7279	19.7420	19.7447	19.7571	19.7571	19.7594	19.7523	19.7447	19.7393	19.7337 (88)
util rest of house	0.9700	0.9458	0.9068	0.8261	0.6928	0.5012	0.3277	0.3585	0.5885	0.8360	0.9447	0.9746 (89)
MIT 2	19.1459	18.5396	18.8563	19.2282	19.4838	19.6224	19.6500	19.6505	19.5876	19.2799	18.7378	18.5151 (90)
Living area fraction									fLA = Living area / (4) =			0.6626 (91)
MIT	19.9415	19.4622	19.7384	20.0654	20.3055	20.4441	20.4819	20.4791	20.4054	20.1059	19.6260	19.4162 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9415	19.4622	19.7384	20.0654	20.3055	20.4441	20.4819	20.4791	20.4054	20.1059	19.6260	19.4162 (93)

8. Space heating requirement

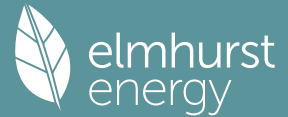
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9713	0.9430	0.9070	0.8366	0.7233	0.5574	0.3992	0.4303	0.6398	0.8492	0.9432	0.9729 (94)
Useful gains	492.3971	562.2723	590.0491	580.1414	511.4270	379.1586	262.4913	273.7395	395.0971	482.3413	480.3713	469.5988 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1113.1899	1033.4896	936.9712	780.0777	599.7629	402.6706	267.4687	280.4582	436.3796	662.5201	877.3249	1071.2308 (97)
Space heating kWh	461.8699	316.6580	258.1100	143.9541	65.7219	0.0000	0.0000	0.0000	0.0000	134.0530	285.8066	447.6142 (98a)
Space heating requirement - total per year (kWh/year)												2113.7878
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	461.8699	316.6580	258.1100	143.9541	65.7219	0.0000	0.0000	0.0000	0.0000	134.0530	285.8066	447.6142 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2113.7878
Space heating per m2										(98c) / (4) =		43.2002 (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 %)												226.6376 (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	461.8699	316.6580	258.1100	143.9541	65.7219	0.0000	0.0000	0.0000	0.0000	134.0530	285.8066	447.6142 (98)
Space heating efficiency (main heating system 1)	226.6376	226.6376	226.6376	226.6376	226.6376	0.0000	0.0000	0.0000	0.0000	226.6376	226.6376	226.6376 (210)
Space heating fuel (main heating system)	203.7923	139.7200	113.8867	63.5173	28.9987	0.0000	0.0000	0.0000	0.0000	59.1486	126.1073	197.5022 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Efficiency of water heater	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048 (216)
Fuel for water heating, kWh/month	107.6317	95.2756	101.3871	89.4825	86.9890	74.6474	73.6477	76.5654	77.4021	90.4632	95.8250	106.4949 (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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.0863	-37.3983	-56.5393	-65.5006	-71.1928	-64.0104	-63.1584	-58.7009	-50.6338	-42.7456	-27.9785	-21.3873 (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												932.6731 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.0048
Water heating fuel used												1075.8117 (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)												114.0548 (232)

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

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PV generation	-584.3321	(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	1538.2075	(238)

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	932.6731	0.1557	145.1881 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1075.8117	0.1412	151.8610 (264)
Space and water heating			297.0491 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	114.0548	0.1443	16.4616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-584.3321	0.1343	-78.4553
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-78.4553 (269)
Total CO ₂ , kg/year			235.0555 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8000 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	932.6731	1.5763	1470.1544 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1075.8117	1.5220	1637.3585 (278)
Space and water heating			3107.5129 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	114.0548	1.5338	174.9411 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-584.3321	1.4962	-874.2871
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-874.2871 (283)
Total Primary energy kWh/year			2408.1669 (286)
Dwelling Primary energy Rate (DPER)			49.2200 (287)

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

1. Overall dwelling characteristics

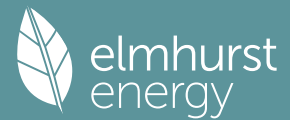
	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	153.6402 (5)

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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (25)

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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 Opening Type			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1300	6.3609			(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502			(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544			(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.1563		(33)

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

217.7126 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	5.7700	0.0500	0.2885	
E2 Other lintels (including other steel lintels)	5.7700	0.0500	0.2885	
E3 Sill	9.6400	0.0500	0.4820	
E4 Jamb	22.8400	0.1600	3.6544	
E5 Ground floor (normal)	6.2500	0.0900	0.5625	
E16 Corner (normal)	6.2800	0.0600	0.3768	
E18 Party wall between dwellings	5.7170	0.0800	0.4574	
P1 Party wall - Ground floor	6.4000	0.0800	0.5120	
P5 Party wall - Roof (insulation at rafter level)	17.1400	0.0800	1.3712	
E13 Gable (insulation at rafter level)	6.4000	0.0400	0.2560	
E11 Eaves (insulation at rafter level)	8.5700	0.0800	0.6856	
R4 Ridge (vaulted ceiling)				

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

8.9349 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 44.0912 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Heat transfer coeff	74.5382	74.3403	74.1463	73.2352	73.0647	72.2712	72.2712	72.1242	72.5768	73.0647	73.4096	73.7701	(39)
Average = Sum(39)m / 12 =												73.2344	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5234	1.5193	1.5154	1.4967	1.4932	1.4770	1.4770	1.4740	1.4833	1.4932	1.5003	1.5077	(40)
HLP (average)												1.4967	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

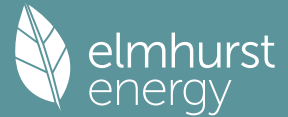
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586 (42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)
Average daily hot water use (litres/day)												90.3022	(43)
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	(44)
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)
Energy content (annual)										Total = Sum(45)m =		1500.0391	
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)
Water storage loss (or HIU loss):													
Store volume												80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9749	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.5264	(55)
Total storage loss	16.3190	14.7398	16.3190	15.7926	16.3190	15.7926	16.3190	16.3190	15.7926	16.3190	15.7926	16.3190	(56)
If cylinder contains dedicated solar storage	16.3190	14.7398	16.3190	15.7926	16.3190	15.7926	16.3190	16.3190	15.7926	16.3190	15.7926	16.3190	(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	195.4019	172.7863	183.4745	161.0643	155.9733	140.3726	138.3897	143.9626	145.6343	162.6093	173.1790	193.2306	(62)
WWHRS	-30.5247	-26.9963	-28.2689	-23.4078	-21.8152	-18.6674	-17.4978	-18.6071	-19.3141	-22.7692	-25.7947	-29.9594	(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	164.8772	145.7900	155.2055	137.6565	134.1581	121.7052	120.8919	125.3555	126.3202	139.8401	147.3843	163.2712	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1682.4558	(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	83.4754	74.1650	79.5096	71.4613	70.3654	64.5813	64.5189	66.3719	66.3308	72.5719	75.4894	82.7535	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)	112.1982	110.3646	106.8677	99.2518	94.5772	89.6962	86.7189	89.2095	92.1261	97.5429	104.8464	111.2278	(72)

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Total internal gains
380.6278 388.1248 373.0189 359.7978 342.5356 327.5505 315.7629 316.7545 325.8850 339.9070 359.7981 373.2837 (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
South	6.8900				46.7521	0.6300		0.7000		0.7700		98.4446 (78)
West	3.3200				19.6403	0.6300		0.7000		0.7700		19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	499.0001	588.3345	642.5925	685.5462	699.1644	677.7929	655.0320	633.6896	615.0891	560.0617	501.3360	474.7365 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6988	39.8045	39.9086	40.4051	40.4994	40.9441	40.9441	41.0275	40.7717	40.4994	40.3092	40.1122
alpha	3.6466	3.6536	3.6606	3.6937	3.7000	3.7296	3.7296	3.7352	3.7181	3.7000	3.6873	3.6741
util living area	0.9783	0.9606	0.9327	0.8747	0.7759	0.6201	0.4680	0.5002	0.7007	0.8883	0.9616	0.9816 (86)
MIT	19.2839	19.5660	19.9193	20.3469	20.6874	20.9033	20.9739	20.9661	20.8405	20.4016	19.7737	19.2408 (87)
Th 2	19.6700	19.6730	19.6760	19.6900	19.6926	19.7048	19.7048	19.7070	19.7001	19.6926	19.6873	19.6818 (88)
util rest of house	0.9722	0.9498	0.9139	0.8390	0.7114	0.5171	0.3384	0.3702	0.6048	0.8488	0.9491	0.9764 (89)
MIT 2	17.7475	18.1018	18.5402	19.0609	19.4392	19.6506	19.6968	19.6956	19.5991	19.1394	18.3771	17.7010 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.7655	19.0720	19.4540	19.9130	20.2662	20.4806	20.5429	20.5374	20.4217	19.9757	19.3025	18.7212 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7655	19.0720	19.4540	19.9130	20.2662	20.4806	20.5429	20.5374	20.4217	19.9757	19.3025	18.7212 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9667	0.9437	0.9102	0.8458	0.7417	0.5810	0.4238	0.4555	0.6609	0.8585	0.9445	0.9714 (94)
Useful gains	482.3917	555.2211	584.8907	579.8269	518.5425	393.7660	277.5953	288.6551	406.4864	480.8203	473.5369	461.1406 (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	1078.2318	1053.5492	960.4885	806.5395	625.8877	425.0003	284.9608	298.4084	458.8054	685.0317	895.7778	1071.2314 (97)
Space heating kWh	443.3050	334.8765	279.4447	163.2331	79.8649	0.0000	0.0000	0.0000	0.0000	151.9332	304.0135	453.9076 (98a)
Space heating requirement - total per year (kWh/year)	2210.5784											
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	443.3050	334.8765	279.4447	163.2331	79.8649	0.0000	0.0000	0.0000	0.0000	151.9332	304.0135	453.9076 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2210.5784											
Space heating per m2	(98c) / (4) = 45.1784 (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	443.3050	334.8765	279.4447	163.2331	79.8649	0.0000	0.0000	0.0000	0.0000	151.9332	304.0135	453.9076 (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)	480.2871	362.8131	302.7570	176.8506	86.5275	0.0000	0.0000	0.0000	0.0000	164.6081	329.3754	491.7742 (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	164.8772	145.7900	155.2055	137.6565	134.1581	121.7052	120.8919	125.3555	126.3202	139.8401	147.3843	163.2712 (64)
Water heating requirement	86.1655	85.8628	85.3623	84.4429	82.9367	79.8000	79.8000	79.8000	79.8000	84.2462	85.6462	79.8000 (216)
Efficiency of water heater	191.3495	169.7941	181.8199	163.0172	161.7597	152.5128	151.4936	157.0871	158.2960	165.9899	172.0851	189.3497 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
(221)m	15.1876	12.1841	10.9704	8.0374	6.2083	5.0722	5.6634	7.3615	9.5619	12.5458	14.1704	15.6098 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-38.9228	-51.7219	-70.1836	-74.4450	-76.8261	-70.6354	-69.8455	-67.6130	-63.1812	-57.0318	-41.6971	-34.0444 (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)	-32.7203	-67.2292	-130.7421	-192.3228	-250.4835	-250.2149	-247.1665	-210.8858	-156.8367	-94.5864	-43.1650	-25.9868 (233b)
(233b)m												

elmhurst
energy

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

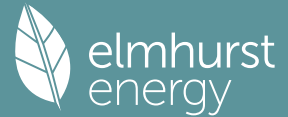
13a. Primary energy - Individual heating systems including micro-CHP

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

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (5)

		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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											20.0000 / (5) =	0.1302 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3802 (18)
Number of sides sheltered													1 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3517 (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 infiltr 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)
	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(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	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(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								
Windows			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000	(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999	(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	35.1563			(33)
Main dwelling								
GF			53.0800			9.0000	477.7200	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10652.6799 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 217.7126 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577
E3 Sill	5.7700	0.0390	0.2250
E4 Jamb	9.6400	0.0520	0.5013
E5 Ground floor (normal)	22.8400	0.0750	1.7130
E16 Corner (normal)	6.2500	0.0360	0.2250
E18 Party wall between dwellings	6.2800	0.0990	0.6217
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104
E13 Gable (insulation at rafter level)	17.1400	0.0510	0.8741
E11 Eaves (insulation at rafter level)	6.4000	0.0080	0.0512
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5655 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 40.7218 (37)

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

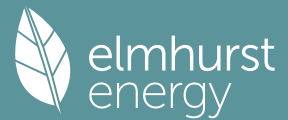
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Average = Sum(39)m / 12 =	71.1688	70.9709	70.7769	69.8658	69.6953	68.9018	68.9018	68.7548	69.2074	69.6953	70.0402	69.8650	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4545	1.4505	1.4465	1.4279	1.4244	1.4082	1.4082	1.4052	1.4144	1.4244	1.4314	1.4388	(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												1.6586 (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	22.4976	22.1635	21.6930	20.8255	20.1759	19.4555	19.0665	19.5337	20.0424	20.8132	21.6986	22.4216 (42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												49.6009 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378 (44)
Distribution loss (46)m = 0.15 x (45)m	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101 (45)
	Total = Sum(45)m =											823.7641
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											700.1995 (64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670 (64a)
												473.9595 (64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672 (72)
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231 (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
South					6.8900	46.7521		0.6300	0.7000	0.7700			98.4446 (78)
West					3.3200	19.6403		0.6300	0.7000	0.7700			19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379		101.4528 (83)
Total gains	422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356		398.6759 (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	41.5783	41.6943	41.8085	42.3537	42.4573	42.9463	42.9463	43.0381	42.7566	42.4573	42.2483	42.0319
alpha	3.7719	3.7796	3.7872	3.8236	3.8305	3.8631	3.8631	3.8692	3.8504	3.8305	3.8166	3.8021
util living area	0.9869	0.9728	0.9493	0.8965	0.8023	0.6450	0.4890	0.5248	0.7312	0.9137	0.9750	0.9893 (86)
MIT	19.2265	19.5187	19.8807	20.3240	20.6756	20.9012	20.9738	20.9653	20.8322	20.3649	19.7188	19.1830 (87)
Th 2	19.7218	19.7249	19.7279	19.7420	19.7447	19.7571	19.7594	19.7523	19.7523	19.7447	19.7393	19.7337 (88)
util rest of house	0.9831	0.9650	0.9345	0.8655	0.7424	0.5444	0.3597	0.3951	0.6395	0.8811	0.9665	0.9862 (89)
MIT 2	18.1536	18.4426	18.7964	19.2249	19.5349	19.7127	19.7505	19.7498	19.6667	19.2747	18.6535	18.1193 (90)
Living area fraction	18.8645	19.1556	19.5148	19.9531	20.2907	20.5002	20.5610	20.5552	20.4389	19.9970	19.3594	18.8241 (92)
MIT	18.8645	19.1556	19.5148	19.9531	20.2907	20.5002	20.5610	20.5552	20.4389	19.9970	19.3594	18.8241 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8645	19.1556	19.5148	19.9531	20.2907	20.5002	20.5610	20.5552	20.4389	19.9970	19.3594	18.8241 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9797	0.9607	0.9316	0.8713	0.7704	0.6068	0.4449	0.4802	0.6929	0.8886	0.9632	0.9832 (94)
Useful gains	413.7026	492.3602	529.8350	537.2029	487.6287	374.7546	265.5507	275.7168	383.8181	437.7133	413.4524	391.9782 (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	1036.5350	1011.7331	921.1480	772.2343	598.7332	406.5338	272.9217	285.6880	438.7013	654.9304	858.6473	1029.5473 (97)
Space heating kWh	463.3873	349.0186	291.1369	169.2226	82.6618	0.0000	0.0000	0.0000	0.0000	161.6095	320.5403	474.3514 (98a)
Space heating requirement - total per year (kWh/year)												2311.9283
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	463.3873	349.0186	291.1369	169.2226	82.6618	0.0000	0.0000	0.0000	0.0000	161.6095	320.5403	474.3514 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2311.9283
Space heating per m2										(98c) / (4) =		47.2497 (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	647.6768	509.8732	522.5367	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8219	0.8881	0.8703	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	532.2953	452.8017	454.7665	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.8664	673.1160	647.9768	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	117.7712	163.9139	143.7484	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	29.4428	40.9785	35.9371	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												106.3584 (107)
Energy for space heating												47.2497 (99)
Energy for space cooling												2.1737 (108)
Total												49.4234 (109)
Fabric Energy Efficiency (DFEE)												49.4 (109)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) =	0.1302 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3802	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3517 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (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	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
TER Opening Type			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609		(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502		(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544		(30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1563		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 217.7126 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0500	0.2885
E3 Sill	5.7700	0.0500	0.2885
E4 Jamb	9.6400	0.0500	0.4820
E5 Ground floor (normal)	22.8400	0.1600	3.6544
E16 Corner (normal)	6.2500	0.0900	0.5625
E18 Party wall between dwellings	6.2800	0.0600	0.3768
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.0800	0.5120
E13 Gable (insulation at rafter level)	17.1400	0.0800	1.3712
E11 Eaves (insulation at rafter level)	6.4000	0.0400	0.2560
R4 Ridge (vaulted ceiling)	8.5700	0.0800	0.6856

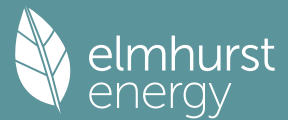
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9349 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 44.0912 (37)

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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789 (38)
Heat transfer coeff	74.5382	74.3403	74.1463	73.2352	73.0647	72.2712	72.2712	72.1242	72.5768	73.0647	73.4096	73.7701 (39)
Average = Sum(39)m / 12 =												73.2344

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5234	1.5193	1.5154	1.4967	1.4932	1.4770	1.4770	1.4740	1.4833	1.4932	1.5003	1.5077 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												1.6586 (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	(42a)
Hot water usage for baths	22.4976	22.1635	21.6930	20.8255	20.1759	19.4555	19.0665	19.5337	20.0424	20.8132	21.6986	22.4216 (42b)
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162 (42c)
Average daily hot water use (litres/day)												49.6009 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content	54.1138	52.6300	51.0098	48.9926	47.1933	45.3233	44.9343	46.5512	48.2096	50.1300	52.1651	54.0378 (44)
Energy content (annual)	85.7031	74.9445	78.4002	67.0685	63.5313	55.7303	54.3441	57.6401	59.4472	68.0259	74.3187	84.6101 (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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (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	72.8476	63.7028	66.6402	57.0082	54.0016	47.3708	46.1925	48.9941	50.5301	57.8221	63.1709	71.9186 (64)
12Total per year (kWh/year)												700.1995 (64)
Electric shower(s)	41.6670	37.1256	40.5398	38.6866	39.4125	37.5957	38.8489	39.4125	38.6866	40.5398	39.7775	41.6670 (64a)
Heat gains from water heating, kWh/month	28.6287	25.2071	26.7950	23.9237	23.3535	21.2416	21.2604	22.1017	22.3042	24.5905	25.7371	28.3964 (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	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324	82.9324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.0947	80.9263	73.0947	75.5312	73.0947	75.5312	73.0947	73.0947	75.5312	73.0947	75.5312	73.0947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	144.4552	145.9542	142.1768	134.1351	123.9840	114.4433	108.0696	106.5706	110.3480	118.3897	128.5408	138.0815 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932	31.2932 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	38.4794	37.5106	36.0148	33.2274	31.3892	29.5023	28.5757	29.7065	30.9780	33.0517	35.7460	38.1672 (72)
Total internal gains	303.9090	312.2708	299.1660	290.7734	276.3476	267.3565	257.6197	257.2515	264.7369	272.4158	287.6977	297.2231 (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					
South				6.8900	46.7521	0.6300		0.7000		0.7700	98.4446 (78)				
West				3.3200	19.6403	0.6300		0.7000		0.7700	19.9277 (80)				
Solar gains				118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains				422.2813	512.4805	568.7396	616.5217	632.9764	617.5989	596.8889	574.1866	553.9410	492.5705	429.2356	398.6759 (84)

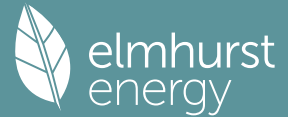
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6988	39.8045	39.9086	40.4051	40.4994	40.9441	40.9441	41.0275	40.7717	40.4994	40.3092	40.1122
alpha	3.6466	3.6536	3.6606	3.6937	3.7000	3.7296	3.7296	3.7352	3.7181	3.7000	3.6873	3.6741
util living area	0.9871	0.9737	0.9517	0.9026	0.8142	0.6631	0.5077	0.5438	0.7466	0.9187	0.9758	0.9894 (86)
MIT	19.1221	19.4159	19.7874	20.2485	20.6256	20.8787	20.9658	20.9553	20.8007	20.2989	19.6296	19.0780 (87)
Th 2	19.6700	19.6730	19.6760	19.6900	19.6926	19.7048	19.7048	19.7070	19.7001	19.6926	19.6873	19.6818 (88)
util rest of house	0.9833	0.9661	0.9373	0.8723	0.7544	0.5588	0.3698	0.4061	0.6533	0.8868	0.9674	0.9863 (89)
MIT 2	18.0133	18.3040	18.6677	19.1145	19.4498	19.6503	19.6964	19.6948	19.5982	19.1735	18.5282	17.9781 (90)
Living area fraction	18.7479	19.0407	19.4096	19.8658	20.2289	20.4642	20.5375	20.5300	20.3950	19.9191	19.2580	18.7069 (92)
MIT	18.7479	19.0407	19.4096	19.8658	20.2289	20.4642	20.5375	20.5300	20.3950	19.9191	19.2580	18.7069 (93)
Temperature adjustment	18.7479	19.0407	19.4096	19.8658	20.2289	20.4642	20.5375	20.5300	20.3950	19.9191	19.2580	18.7069 (93)
adjusted MIT	18.7479	19.0407	19.4096	19.8658	20.2289	20.4642	20.5375	20.5300	20.3950	19.9191	19.2580	18.7069 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	413.7223	492.7573	531.0843	540.6388	494.3779	384.5475	274.8749	284.9433	391.3608	439.9675	413.7494	391.9626 (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)

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Heat loss rate W	1076.9225	1051.2259	957.1962	803.0857	623.1593	423.8126	284.5644	297.8748	456.8685	680.9003	892.5143	1070.1743 (97)
Space heating kWh	493.4210	375.2909	317.0272	188.9618	95.8134	0.0000	0.0000	0.0000	0.0000	179.2540	344.7107	504.5895 (98a)
Space heating requirement - total per year (kWh/year)												2499.0685
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	493.4210	375.2909	317.0272	188.9618	95.8134	0.0000	0.0000	0.0000	0.0000	179.2540	344.7107	504.5895 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2499.0685
Space heating per m2											(98c) / (4) =	51.0744 (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	679.3490	534.8067	548.1441	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7979	0.8686	0.8493	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	542.0746	464.5254	465.5291	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	695.8664	673.1160	647.9768	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	110.7301	155.1914	135.7410	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	27.6825	38.7979	33.9353	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												100.4156 (107)
Energy for space heating												51.0744 (99)
Energy for space cooling												2.0522 (108)
Total												53.1266 (109)
Fabric Energy Efficiency (TFEE)												53.1 (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	48.9300 (1b)	3.1400 (2b)	153.6402 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		153.6402 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 153.6402 (5)

2. Ventilation rate

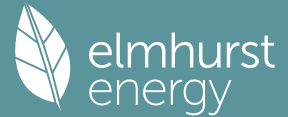
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (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	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132 (22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854 (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							
Windows			10.2100	1.1450	11.6908		
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m2)			175.5700				

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	35.1563	(33)										
Main dwelling													
GF	53.0800	9.0000	477.7200 (32e)										
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10652.6799	(34)										
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		217.7126	(35)										
List of Thermal Bridges													
K1 Element	Length	Psi-value	Total										
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577										
E3 Sill	5.7700	0.0390	0.2250										
E4 Jamb	9.6400	0.0520	0.5013										
E5 Ground floor (normal)	22.8400	0.0750	1.7130										
E16 Corner (normal)	6.2500	0.0360	0.2250										
E18 Party wall between dwellings	6.2800	0.0990	0.6217										
P1 Party wall - Ground floor	5.7170	0.0800	0.4574										
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104										
E13 Gable (insulation at rafter level)	17.1400	0.0510	0.8741										
E11 Eaves (insulation at rafter level)	6.4000	0.0080	0.0512										
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.5655 (36)										
Point Thermal bridges		(36a) =	0.0000										
Total fabric heat loss		(33) + (36) + (36a) =	40.7218 (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	30.4470	30.2491	30.0551	29.1440	28.9735	28.1800	28.1800	28.0330	28.4856	28.9735	29.3184	29.6789	(38)
Average = Sum(39)m / 12 =	71.1688	70.9709	70.7769	69.8658	69.6953	68.9018	68.9018	68.7548	69.2074	69.6953	70.0402	70.4007	(39)
												69.8650	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4545	1.4505	1.4465	1.4279	1.4244	1.4082	1.4082	1.4052	1.4144	1.4244	1.4314	1.4388	(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													1.6586 (42)
Hot water usage for mixer showers													
66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)	
Hot water usage for baths													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses													
31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)	
Average daily hot water use (litres/day)												90.3022	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309	(44)
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	1500.0391	
23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)	
Water storage loss (or HIU loss):													
Store volume												80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.6000	(55)
Total storage loss													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(56)
If cylinder contains dedicated solar storage													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	23.2624	22.5120	31.1612	30.1560	31.1612	(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													
205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(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)
Heat gains from water heating, kWh/month													
91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973	(65)	

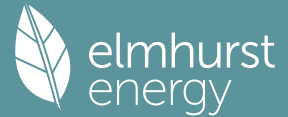
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738 (72)
Total internal gains	434.6781	433.2766	421.4638	399.0122	376.9573	348.3152	336.2736	338.3321	349.5646	378.3105	402.9942	424.6434 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
South	6.8900				46.7521	0.6300		0.7000		0.7700		98.4446 (78)
West	3.3200				19.6403	0.6300		0.7000		0.7700		19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	553.0504	633.4863	691.0374	724.7605	733.5862	698.5576	675.5427	655.2672	638.7687	598.4651	544.5321	526.0962 (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	41.5783	41.6943	41.8085	42.3537	42.4573	42.9463	42.9463	43.0381	42.7566	42.4573	42.2483	42.0319
alpha	3.7719	3.7796	3.7872	3.8236	3.8305	3.8631	3.8631	3.8692	3.8504	3.8305	3.8166	3.8021
util living area	0.9694	0.9490	0.9140	0.8489	0.7413	0.5872	0.4373	0.4673	0.6662	0.8613	0.9489	0.9740 (86)
Living	19.7938	19.9845	20.2373	20.5206	20.7385	20.8666	20.9067	20.9028	20.8295	20.5566	20.1283	19.7601
Non living	18.3651	18.6036	18.9146	19.2594	19.4969	19.6249	19.6504	19.6511	19.5931	19.3115	18.7981	18.3321
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	20.3830	19.9845	20.2373	20.5206	20.7385	20.8666	20.9067	20.9028	20.8295	20.5566	20.1283	19.9335 (87)
Th 2	19.7218	19.7249	19.7279	19.7420	19.7447	19.7571	19.7571	19.7594	19.7523	19.7447	19.7393	19.7337 (88)
util rest of house	0.9611	0.9358	0.8918	0.8098	0.6758	0.4896	0.3193	0.3484	0.5728	0.8172	0.9333	0.9669 (89)
MIT 2	19.1809	18.6036	18.9146	19.2594	19.4969	19.6249	19.6504	19.6511	19.5931	19.3115	18.7981	18.5847 (90)
Living area fraction	fLA = Living area / (4) = 0.6626 (91)											
MIT	19.9774	19.5186	19.7910	20.0951	20.3196	20.4476	20.4828	20.4804	20.4123	20.1364	19.6795	19.4784 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.9774	19.5186	19.7910	20.0951	20.3196	20.4476	20.4828	20.4804	20.4123	20.1364	19.6795	19.4784 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9630	0.9334	0.8930	0.8218	0.7075	0.5455	0.3893	0.4188	0.6244	0.8324	0.9325	0.9652 (94)
Useful gains	532.5703	591.2646	617.1225	595.5749	518.9875	381.0583	262.9700	274.4265	398.8677	498.1491	507.7641	507.7847 (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	1115.7390	1037.4919	940.6978	782.1515	600.7459	402.9105	267.5324	280.5483	436.8610	664.6453	881.0680	1075.6098 (97)
Space heating kWh	433.8776	299.8647	240.7401	134.3352	60.8282	0.0000	0.0000	0.0000	0.0000	123.8732	268.7789	422.4619 (98a)
Space heating requirement - total per year (kWh/year)	1984.7596											
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	433.8776	299.8647	240.7401	134.3352	60.8282	0.0000	0.0000	0.0000	0.0000	123.8732	268.7789	422.4619 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1984.7596											
Space heating per m2	(98c) / (4) = 40.5632 (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 %)												226.6376 (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	433.8776	299.8647	240.7401	134.3352	60.8282	0.0000	0.0000	0.0000	0.0000	123.8732	268.7789	422.4619 (98)
Space heating efficiency (main heating system 1)	226.6376	226.6376	226.6376	226.6376	226.6376	0.0000	0.0000	0.0000	0.0000	226.6376	226.6376	226.6376 (210)
Space heating fuel (main heating system)	191.4411	132.3102	106.2225	59.2731	26.8394	0.0000	0.0000	0.0000	0.0000	54.6569	118.5941	186.4042 (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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104 (64)
Efficiency of water heater (217)m	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048 (216)
Fuel for water heating, kWh/month	107.6317	95.2756	101.3871	89.4825	86.9890	74.6474	73.6477	76.5654	77.4021	90.4632	95.8250	106.4949 (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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.0050	-37.2694	-56.2670	-65.2183	-70.9752	-64.0104	-63.1584	-58.7009	-50.6338	-42.5922	-27.8903	-21.3281 (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)												

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(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												875.7417	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.0048	
Water heating fuel used												1075.8117	(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)												114.0548	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-583.0491	(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												1482.5590	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	875.7417	16.4900	144.4098	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1075.8117	16.4900	177.4013	(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	114.0548	16.4900	18.8076	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-583.0491	16.4900	-96.1448	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-96.1448	(252)
Total energy cost			244.4740	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.9370	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	84.8115	
SAP rating (Section 12)		85	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	875.7417	0.1557	136.3704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1075.8117	0.1412	151.8610	(264)
Space and water heating			288.2314	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	114.0548	0.1443	16.4616	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-583.0491	0.1342	-78.2668	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-78.2668	(269)
Total CO2, kg/year			226.4262	(272)
CO2 emissions per m2			4.6300	(273)
EI value			96.7698	
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

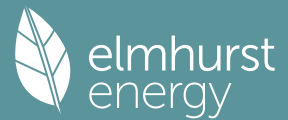
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	48.9300	3.1400	153.6402	(1b) - (3b)
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300			(5)
Dwelling volume				

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000	(6a)
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Number of open flues
Number of chimneys / flues attached to closed fire
Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6b)
0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
2 * 10 = 20.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1302 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3802 (18)
Number of sides sheltered 1 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3517 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000	(22)
Adj infilt rate	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000	(22a)
Effective ac	0.3868	0.3780	0.3780	0.3341	0.3341	0.2901	0.2901	0.2989	0.2989	0.3253	0.3341	0.3517	(22b)
	0.5748	0.5715	0.5715	0.5558	0.5558	0.5421	0.5421	0.5447	0.5447	0.5529	0.5558	0.5618	(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								
Windows			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000	(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999	(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.1563			(33)
Main dwelling								
GF			53.0800			9.0000	477.7200	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 10652.6799 (34)
List of Thermal Bridges 217.7126 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577
E3 Sill	5.7700	0.0390	0.2250
E4 Jamb	9.6400	0.0520	0.5013
E5 Ground floor (normal)	22.8400	0.0750	1.7130
E16 Corner (normal)	6.2500	0.0360	0.2250
E18 Party wall between dwellings	6.2800	0.0990	0.6217
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104
E13 Gable (insulation at rafter level)	17.1400	0.0510	0.8741
E11 Eaves (insulation at rafter level)	6.4000	0.0080	0.0512
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5655 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.7218 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 29.1440 Feb 28.9735 Mar 28.9735 Apr 28.1800 May 28.1800 Jun 27.4844 Jul 27.4844 Aug 27.6157 Sep 27.6157 Oct 28.0330 Nov 28.1800 Dec 28.4856 (38)
Heat transfer coeff 69.8658 69.6953 69.6953 68.9018 68.9018 68.2062 68.2062 68.3375 68.3375 68.7548 68.9018 69.2074 (39)
Average = Sum(39)m / 12 = 68.9176

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4279	1.4244	1.4244	1.4082	1.4082	1.3940	1.3940	1.3966	1.3966	1.4052	1.4082	1.4144	(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													1.6586 (42)
Hot water usage for mixer showers													
66.7705 65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147			(42a)
Hot water usage for baths													
0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(42b)
Hot water usage for other uses													
31.6162 30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162			(42c)
Average daily hot water use (litres/day)													90.3022 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
98.3867 96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309			(44)
Energy conte 155.8205 137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492			(45)
Energy content (annual)													Total = Sum(45)m = 1500.0391
Distribution loss (46)m = 0.15 x (45)m													
23.3731 20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474			(46)
Water storage loss (or HIU loss):													
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.6000 (55)
Total storage loss													
18.6000 16.8000	18.6000	18.0000	18.6000	18.0000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000			(56)
If cylinder contains dedicated solar storage													
18.6000 16.8000	18.6000	18.0000	18.6000	18.0000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000			(57)
Primary loss	31.1612	28.1456	31.1612	30.1560	31.1612	22.5120	23.2624	22.5120	31.1612	30.1560			(59)
Combi loss	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													
205.5817 181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104			(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			(63a)

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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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(64)
Total per year (kWh/year) = Sum(64)m =													2054.8515 (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	91.6193	81.5207	87.6534	79.3424	78.5093	66.3472	66.3437	68.1967	68.0967	80.7157	83.3705	90.8973	(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	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	(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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	(71)
Water heating gains (Table 5)	123.1442	121.3106	117.8137	110.1978	105.5232	92.1489	89.1716	91.6622	94.5788	108.4889	115.7924	122.1738	(72)
Total internal gains	434.6781	433.2766	421.4638	399.0122	376.9573	348.3152	336.2736	338.3321	349.5646	378.3105	402.9942	424.6434	(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	
South				6.8900	51.7504	0.6300	0.7000		0.7700		108.9694 (78)	
West				3.3200	22.4175	0.6300	0.7000		0.7700		22.7456 (80)	
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889	111.8388 (83)
Total gains	566.3931	640.6585	695.7128	737.1836	739.1541	721.9457	694.0213	673.2797	656.6430	616.5047	564.2831	536.4823 (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	42.3537	42.4573	42.4573	42.9463	42.9463	43.3843	43.3843	43.3009	43.3009	43.0381	42.9463	42.7566
alpha	3.8236	3.8305	3.8305	3.8631	3.8631	3.8923	3.8923	3.8867	3.8867	3.8692	3.8631	3.8504
util living area	0.9653	0.9443	0.9041	0.8252	0.7042	0.5150	0.3498	0.3607	0.5980	0.8284	0.9387	0.9709 (86)
Living	19.8694	20.0473	20.3064	20.5881	20.7829	20.8912	20.9158	20.9151	20.8665	20.6364	20.2118	19.8292
Non living	18.4750	18.6964	19.0111	19.3474	19.5512	19.6523	19.6653	19.6630	19.6347	19.4109	18.9136	18.4330
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	20.4216	20.0473	20.3064	20.5881	20.7829	20.8912	20.9158	20.9151	20.8665	20.6364	20.2118	19.9930 (87)
Th 2	19.7420	19.7447	19.7447	19.7571	19.7571	19.7680	19.7680	19.7659	19.7659	19.7594	19.7571	19.7523 (88)
util rest of house	0.9560	0.9301	0.8795	0.7813	0.6324	0.4135	0.2321	0.2394	0.4968	0.7758	0.9204	0.9630 (89)
MIT 2	19.2369	18.6964	19.0111	19.3474	19.5512	19.6523	19.6653	19.6630	19.6347	19.4109	18.9136	18.6707 (90)
Living area fraction	20.0219	19.5915	19.8693	20.1694	20.3673	20.4731	20.4939	20.4926	fLA = Living area / (4) =	20.2229	19.7738	0.6626 (91)
MIT	20.0219	19.5915	19.8693	20.1694	20.3673	20.4731	20.4939	20.4926	20.4509	20.2229	19.7738	19.5468 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0219	19.5915	19.8693	20.1694	20.3673	20.4731	20.4939	20.4926	20.4509	20.2229	19.7738	19.5468 (93)

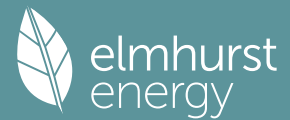
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9583	0.9281	0.8823	0.7970	0.6693	0.4729	0.3020	0.3115	0.5548	0.7971	0.9207	0.9615	(94)
Useful gains	542.7862	594.5752	613.7960	587.5101	494.7255	341.3776	209.5901	209.7309	364.3298	491.4181	519.5250	515.8191	(95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000	(96)
Heat loss rate W	1084.4493	1009.9868	903.9008	742.0337	555.8489	352.8405	211.0213	211.3417	386.1667	620.3699	852.5743	1048.2714	(97)
Space heating kWh	402.9973	279.1566	215.8380	111.2570	45.4758	0.0000	0.0000	0.0000	0.0000	95.9401	239.7955	396.1445	(98a)
Space heating requirement - total per year (kWh/year)												1786.6049	
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	402.9973	279.1566	215.8380	111.2570	45.4758	0.0000	0.0000	0.0000	0.0000	95.9401	239.7955	396.1445	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1786.6049	
Space heating per m2										(98c) / (4) =		36.5135	(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 %)	226.3115	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.9973	279.1566	215.8380	111.2570	45.4758	0.0000	0.0000	0.0000	0.0000	95.9401	239.7955	396.1445	(98)
Space heating efficiency (main heating system 1)	226.3115	226.3115	226.3115	226.3115	226.3115	0.0000	0.0000	0.0000	0.0000	226.3115	226.3115	226.3115	(210)
Space heating fuel (main heating system)	178.0720	123.3506	95.3721	49.1610	20.0944	0.0000	0.0000	0.0000	0.0000	42.3930	105.9582	175.0440	(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	205.5817	181.9809	193.6543	170.9157	166.1531	142.5800	140.6706	146.2436	147.8417	172.7891	183.0304	203.4104	(64)
Efficiency of water heater (217)m	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	(216)
Fuel for water heating, kWh/month	107.6157	95.2615	101.3721	89.4692	86.9761	74.6363	73.6368	76.5541	77.3906	90.4498	95.8108	106.4792	(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	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-27.6747	-38.6892	-57.3141	-66.8194	-71.4417	-66.7249	-65.4468	-61.1426	-53.1797	-45.2645	-31.3057	-23.4497	(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												789.4452	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.0331	
Water heating fuel used												1075.6522	(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)												114.0548	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-608.4529	(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												1370.6993	(238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	789.4452	28.4300	224.4393	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1075.6522	28.4300	305.8079	(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	114.0548	28.4300	32.4258	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-608.4529	28.4300	-172.9832	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-172.9832	(252)
Total energy cost			389.6898	(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	789.4452	0.1562	123.3335	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1075.6522	0.1412	151.8385	(264)
Space and water heating			275.1721	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	114.0548	0.1443	16.4616	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-608.4529	0.1344	-81.7687	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-81.7687	(269)
Total CO2, kg/year			209.8650	(272)

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

Energy Primary energy factor Primary energy

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Space heating - main system 1	kWh/year	kg CO2/kWh	kWh/year
Total CO2 associated with community systems	789.4452	1.5784	1246.0214 (275)
Water heating (other fuel)	1075.6522	1.5220	0.0000 (473)
Space and water heating			1637.1158 (278)
Pumps, fans and electric keep-hot	0.0000	0.0000	2883.1371 (279)
Energy for lighting	114.0548	1.5338	0.0000 (281)
			174.9411 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-608.4529	1.4967	-910.6505
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-910.6505 (283)
Total Primary energy kWh/year			2147.4277 (286)

SAP 10 EPC IMPROVEMENTS

BE GREEN annex dwelling

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

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:			
N Solar water heating	SAP change + 2.3	Cost change -£ 71	CO2 change -31 kg (14.8%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£71	0.63 kg/m²	B 87 A 97
Total Savings	£71	0.63 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 589 TEST (12 Dec 2025)
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	£563	£482	£80
Space heating	£224	£248	-£24
Water heating	£306	£202	£104
Lighting	£32	£32	£0
Generated (PV)	-£173	-£163	-£10
Total cost of fuels	£390	£319	£70
Total cost of uses	£389	£319	£70
Delivered energy	28 kWh/m²	23 kWh/m²	5 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	1 kg/m²
Primary energy	44 kWh/m²	36 kWh/m²	7 kWh/m²

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

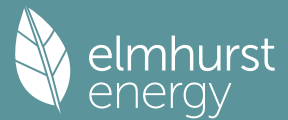
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)

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Number of sides sheltered

1 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3517 \quad (21)$$

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													
Effective ac	0.4484	0.4396	0.4308	0.3868	0.3780	0.3341	0.3341	0.3253	0.3517	0.3780	0.3956	0.4132	(22b)
	0.6005	0.5966	0.5928	0.5748	0.5715	0.5558	0.5558	0.5529	0.5618	0.5715	0.5783	0.5854	(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								
Windows			10.2100	1.1450	11.6908			(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000	(28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999	(29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600	(30)
Total net area of external elements Aum(A, m2)			175.5700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.1563		(33)
Main dwelling								
GF			53.0800			9.0000	477.7200	(32e)

Heat capacity Cm = Sum(A x k)

$$(28)...(30) + (32) + (32a)...(32e) = 10652.6799 \quad (34)$$

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

$$217.7126 \quad (35)$$

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.7700	0.0620	0.3577
E3 Sill	5.7700	0.0390	0.2250
E4 Jamb	9.6400	0.0520	0.5013
E5 Ground floor (normal)	22.8400	0.0750	1.7130
E16 Corner (normal)	6.2500	0.0360	0.2250
E18 Party wall between dwellings	6.2800	0.0990	0.6217
P1 Party wall - Ground floor	5.7170	0.0800	0.4574
P5 Party wall - Roof (insulation at rafter level)	6.4000	0.1110	0.7104
E13 Gable (insulation at rafter level)	17.1400	0.0510	0.8741
E11 Eaves (insulation at rafter level)	6.4000	0.0080	0.0512
R4 Ridge (vaulted ceiling)	8.5700	-0.0200	-0.1714

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

$$5.5655 \quad (36)$$

Point Thermal Bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 40.7218 \quad (37)$$

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

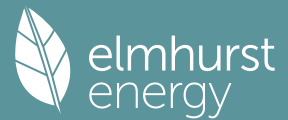
(38)m	Jan 30.4470	Feb 30.2491	Mar 30.0551	Apr 29.1440	May 28.9735	Jun 28.1800	Jul 28.1800	Aug 28.0330	Sep 28.4856	Oct 28.9735	Nov 29.3184	Dec 29.6789	(38)
Heat transfer coeff	71.1688	70.9709	70.7769	69.8658	69.6953	68.9018	68.9018	68.7548	69.2074	69.6953	70.0402	70.4007	(39)
Average = Sum(39)m / 12 =													69.8650

HLP	Jan 1.4545	Feb 1.4505	Mar 1.4465	Apr 1.4279	May 1.4244	Jun 1.4082	Jul 1.4082	Aug 1.4052	Sep 1.4144	Oct 1.4244	Nov 1.4314	Dec 1.4388	(40)
HLP (average)												1.4279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586	(42)
Hot water usage for mixer showers	66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses	31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)	
Average daily hot water use (litres/day)													90.3022	(43)
Daily hot water use	Jan 98.3867	Feb 96.2336	Mar 93.6217	Apr 89.6744	May 86.4601	Jun 83.0080	Jul 81.6993	Aug 84.3001	Sep 87.0405	Oct 90.6623	Nov 94.6697	Dec 98.1309	(44)	
Energy conte	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492	(45)	
Energy content (annual)										Total = Sum(45)m =		1500.0391		
Distribution loss (46)m = 0.15 x (45)m	23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)	
Water storage loss (or HIU loss):														
Store volume													80.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.6000	(55)
Total storage loss	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(56)	
If cylinder contains dedicated solar storage	18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(57)	
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612	(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	205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304	203.4104	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
Effective solar volume													75.0000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.3161	(H16)
Heat delivered to hot water													570.7779	(H24)

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Heat delivered to space heating												0.0000 (H29)
Solar input												570.7779
Solar input	-0.0000	-16.2883	-56.1098	-74.9805	-94.4978	-85.6431	-84.6727	-75.8290	-54.3789	-28.3777	-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	205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304	203.4104 (64)
								Total per year (kWh/year) = Sum(64)m =				1411.0159 (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	91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705	90.8973 (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	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (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)												
	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)												
	123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738 (72)
Total internal gains	434.6781	433.2766	419.4534	388.9602	358.5287	334.3078	322.2661	325.3252	343.5614	376.3001	402.9942	424.6434 (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											
South	6.8900											98.4446 (78)
West	3.3200											19.9277 (80)
Solar gains	118.3723	200.2097	269.5736	325.7483	356.6288	350.2424	339.2691	316.9351	289.2041	220.1547	141.5379	101.4528 (83)
Total gains	553.0504	633.4863	689.0270	714.7085	715.1575	684.5502	661.5353	642.2602	632.7655	596.4547	544.5321	526.0962 (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	41.5783	41.6943	41.8085	42.3537	42.4573	42.9463	42.9463	43.0381	42.7566	42.4573	42.2483	42.0319
alpha	3.7719	3.7796	3.7872	3.8236	3.8305	3.8631	3.8631	3.8692	3.8504	3.8305	3.8166	3.8021
util living area	0.9694	0.9490	0.9146	0.8535	0.7523	0.5967	0.4458	0.4758	0.6706	0.8624	0.9489	0.9740 (86)
Living	19.7938	19.9845	20.2349	20.5115	20.7285	20.8636	20.9058	20.9016	20.8274	20.5546	20.1283	19.7601
Non living	18.3651	18.6036	18.9118	19.2496	19.4879	19.6230	19.6501	19.6507	19.5916	19.3095	18.7981	18.3321
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	20.3830	19.9845	20.2349	20.5115	20.7285	20.8636	20.9058	20.9016	20.8274	20.5546	20.1283	19.9335 (87)
Th 2	19.7218	19.7249	19.7279	19.7420	19.7447	19.7571	19.7571	19.7594	19.7523	19.7447	19.7393	19.7337 (88)
util rest of house	0.9611	0.9358	0.8926	0.8151	0.6876	0.4984	0.3258	0.3552	0.5772	0.8184	0.9333	0.9669 (89)
MIT 2	19.1809	18.6036	18.9118	19.2496	19.4879	19.6230	19.6501	19.6507	19.5916	19.3095	18.7981	18.5847 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.9774	19.5186	19.7885	20.0857	20.3099	20.4450	20.4821	20.4795	20.4104	20.1345	19.6795	19.4784 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9774	19.5186	19.7885	20.0857	20.3099	20.4450	20.4821	20.4795	20.4104	20.1345	19.6795	19.4784 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9630	0.9334	0.8937	0.8265	0.7184	0.5546	0.3970	0.4266	0.6287	0.8335	0.9325	0.9652 (94)
Useful gains	532.5703	591.2646	615.8148	590.7232	513.7914	379.6199	262.6031	273.9678	397.8368	497.1412	507.7641	507.7847 (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	1115.7390	1037.4919	940.5179	781.5004	600.0708	402.7289	267.4836	280.4881	436.7295	664.5100	881.0680	1075.6098 (97)
Space heating kWh	433.8776	299.8647	241.5792	137.3596	64.1918	0.0000	0.0000	0.0000	0.0000	124.5224	268.7789	422.4619 (98a)
Space heating requirement - total per year (kWh/year)												1992.6361
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	433.8776	299.8647	241.5792	137.3596	64.1918	0.0000	0.0000	0.0000	0.0000	124.5224	268.7789	422.4619 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1992.6361
Space heating per m2										(98c) / (4) =		
												40.7242 (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 %)		226.6376 (206)
Efficiency of main space heating system 2 (in %)		0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	433.8776	299.8647	241.5792	137.3596	64.1918	0.0000	0.0000	0.0000	0.0000	124.5224	268.7789	422.4619 (98)
Space heating efficiency (main heating system 1)	226.6376	226.6376	226.6376	226.6376	226.6376	0.0000	0.0000	0.0000	0.0000	226.6376	226.6376	226.6376 (210)
Space heating fuel (main heating system)	191.4411	132.3102	106.5927	60.6076	28.3236	0.0000	0.0000	0.0000	0.0000	54.9434	118.5941	186.4042 (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	205.5817	165.6927	135.6748	86.8884	54.5166	44.3302	42.9710	58.3181	88.0599	142.5417	183.0304	203.4104 (64)
Efficiency of water heater (217)m	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048	191.0048 (216)
Fuel for water heating, kWh/month	107.6317	86.7479	71.0321	45.4902	28.5420	23.2090	22.4974	30.5323	46.1035	74.6273	95.8250	106.4949 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-25.0501	-37.2272	-55.4002	-62.6209	-65.3029	-57.5588	-56.7764	-53.9623	-48.4876	-42.2849	-27.9676	-21.3646 (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												879.2170 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												191.0048
Water heating fuel used												738.7333 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												114.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-554.0036 (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												1258.0015 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	879.2170	16.4900	144.9829 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	738.7333	16.4900	121.8171 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	114.0548	16.4900	18.8076 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0036	16.4900	-91.3552
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-91.3552 (252)
Total energy cost			207.4445 (255)

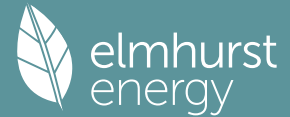
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7951 (257)
SAP value		87.1121
SAP rating (Section 12)		87 (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	879.2170	0.1557	136.8527 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	738.7333	0.1474	108.8683 (264)
Space and water heating			245.7210 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)

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Energy for lighting	114.0548	0.1443	16.4616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-554.0036	0.1349	-74.7153
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-74.7153 (269)
Total CO ₂ , kg/year			198.5643 (272)
CO ₂ emissions per m ²			4.0600 (273)
EI value			97.1673
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 (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	48.9300 (1b)	x 3.1400 (2b)	= 153.6402 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.9300		(5)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.6402 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.1302 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3802 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3517 (21)

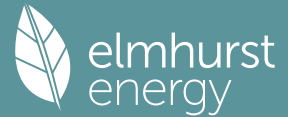
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.3000	4.3000	3.8000	3.8000	3.3000	3.3000	3.4000	3.4000	3.7000	3.8000	4.0000 (22)
Wind factor	1.1000	1.0750	1.0750	0.9500	0.9500	0.8250	0.8250	0.8500	0.8500	0.9250	0.9500	1.0000 (22a)
Adj infilt rate	0.3868	0.3780	0.3780	0.3341	0.3341	0.2901	0.2901	0.2989	0.2989	0.3253	0.3341	0.3517 (22b)
Effective ac	0.5748	0.5715	0.5715	0.5558	0.5558	0.5421	0.5421	0.5447	0.5447	0.5529	0.5558	0.5618 (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							
Windows			10.2100	1.1450	11.6908		(27)
GF			48.9300	0.1300	6.3609	110.0000	5382.3000 (28a)
External Wall	71.6000	10.2100	61.3900	0.1800	11.0502	70.0000	4297.2999 (29a)
SLOPING ROOF	55.0400		55.0400	0.1100	6.0544	9.0000	495.3600 (30)
Total net area of external elements Aum(A, m ²)			175.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.1563	(33)
Main dwelling							
GF			53.0800			9.0000	477.7200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10652.6799 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							217.7126 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				5.7700	0.0620	0.3577	
E3 Sill				5.7700	0.0390	0.2250	
E4 Jamb				9.6400	0.0520	0.5013	
E5 Ground floor (normal)				22.8400	0.0750	1.7130	
E16 Corner (normal)				6.2500	0.0360	0.2250	
E18 Party wall between dwellings				6.2800	0.0990	0.6217	
P1 Party wall - Ground floor				5.7170	0.0800	0.4574	
P5 Party wall - Roof (insulation at rafter level)				6.4000	0.1110	0.7104	
E13 Gable (insulation at rafter level)				17.1400	0.0510	0.8741	
E11 Eaves (insulation at rafter level)				6.4000	0.0080	0.0512	
R4 Ridge (vaulted ceiling)				8.5700	-0.0200	-0.1714	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5655 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	40.7218 (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	29.1440	28.9735	28.9735	28.1800	28.1800	27.4844	27.4844	27.6157	27.6157	28.0330	28.1800	28.4856 (38)

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Average = Sum(39)m / 12 =	69.8658	69.6953	69.6953	68.9018	68.9018	68.2062	68.2062	68.3375	68.3375	68.7548	68.9018	69.2074 (39) 68.9176
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4279	1.4244	1.4244	1.4082	1.4082	1.3940	1.3940	1.3966	1.3966	1.4052	1.4082	1.4144 (40)
HLP (average)												1.4085
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6586 (42)
Hot water usage for mixer showers													
66.7705	65.7671	64.3049	61.5072	59.4426	57.1402	55.8315	57.2826	58.8734	61.3454	64.2032	66.5147	(42a)	
Hot water usage for baths													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses													
31.6162	30.4665	29.3168	28.1672	27.0175	25.8678	25.8678	27.0175	28.1672	29.3168	30.4665	31.6162	(42c)	
Average daily hot water use (litres/day)												90.3022 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.3867	96.2336	93.6217	89.6744	86.4601	83.0080	81.6993	84.3001	87.0405	90.6623	94.6697	98.1309 (44)	
Energy content (annual)	155.8205	137.0353	143.8931	122.7597	116.3919	102.0680	98.8082	104.3812	107.3297	123.0279	134.8744	153.6492 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1500.0391	
23.3731	20.5553	21.5840	18.4140	17.4588	15.3102	14.8212	15.6572	16.0994	18.4542	20.2312	23.0474	(46)	
Water storage loss (or HIU loss):													
Store volume												80.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6000 (55)	
Total storage loss													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(56)	
If cylinder contains dedicated solar storage													
18.6000	16.8000	18.6000	18.0000	18.6000	18.0000	18.6000	18.6000	18.0000	18.6000	18.0000	18.6000	(57)	
Primary loss	31.1612	28.1456	29.2915	21.1092	14.0225	9.9053	10.2355	11.1660	17.1091	29.2915	30.1560	31.1612 (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													
205.5817	181.9809	191.7846	161.8689	149.0145	129.9733	127.6437	134.1471	142.4388	170.9194	183.0304	203.4104	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.8000 (H2)	
Collector linear heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0000 (H4)	
Collector loop efficiency												0.9000 (H5)	
Incidence angle modifier												1.0000 (H6)	
Overshading factor												0.8000 (H8)	
Overall heat loss coefficient of system												6.5000 (H10)	
Heat loss coefficient of collector loop												3.9667 (H11)	
Dedicated solar storage volume												75.0000 (H12)	
Effective solar volume												75.0000 (H14)	
Reference volume												225.0000 (H15)	
Storage tank correction coefficient												1.3161 (H16)	
Heat delivered to hot water												625.3455 (H24)	
Heat delivered to space heating												0.0000 (H29)	
Solar input												625.3455	
Solar input	-0.0000	-19.3083	-59.6151	-80.5194	-97.7685	-92.6874	-90.7902	-82.8081	-61.3341	-35.8541	-4.6602	-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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)	
								Total per year (kWh/year) = Sum(64)m =				1356.4482 (64)	
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)	
Heat gains from water heating, kWh/month													
91.6193	81.5207	86.1577	72.1050	64.7983	56.2618	55.9221	58.5195	63.7744	79.2200	83.3705	90.8973	(65)	

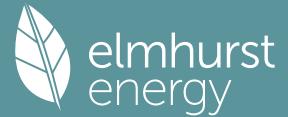
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188	99.5188 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1456	14.3404	11.6624	8.8292	6.5999	5.5719	6.0207	7.8259	10.5039	13.3371	15.5664	16.5944 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6048	217.8421	212.2042	200.2017	185.0507	170.8109	161.2979	159.0606	164.6985	176.7010	191.8520	206.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105	46.6105 (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)	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459	-66.3459 (71)
Water heating gains (Table 5)	123.1442	121.3106	115.8033	100.1458	87.0946	78.1415	75.1641	78.6552	88.5756	106.4785	115.7924	122.1738 (72)
Total internal gains	434.6781	433.2766	419.4534	388.9602	358.5287	334.3078	322.2661	325.3252	343.5614	376.3001	402.9942	424.6434 (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			
South				6.8900	51.7504	0.6300	0.7000		108.9694 (78)			
West				3.3200	22.4175	0.6300	0.7000	0.7700	22.7456 (80)			
Solar gains	131.7150	207.3819	274.2490	338.1714	362.1967	373.6304	357.7477	334.9476	307.0784	238.1943	161.2889	111.8388 (83)
Total gains	566.3931	640.6585	693.7024	727.1316	720.7254	707.9382	680.0138	660.2727	650.6398	614.4943	564.2831	536.4823 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.3537	42.4573	42.4573	42.9463	42.9463	43.3843	43.3843	43.3009	43.3009	43.0381	42.9463	42.7566
alpha	3.8236	3.8305	3.8305	3.8631	3.8631	3.8923	3.8923	3.8867	3.8867	3.8692	3.8631	3.8504
util living area	0.9653	0.9443	0.9048	0.8301	0.7157	0.5238	0.3567	0.3675	0.6023	0.8295	0.9387	0.9709 (86)
Living	19.8694	20.0473	20.3040	20.5799	20.7747	20.8894	20.9155	20.9148	20.8652	20.6348	20.2118	19.8292
Non living	18.4750	18.6964	19.0085	19.3389	19.5443	19.6514	19.6652	19.6629	19.6339	19.4093	18.9136	18.4330
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	20.4216	20.0473	20.3040	20.5799	20.7747	20.8894	20.9155	20.9148	20.8652	20.6348	20.2118	19.9930 (87)
Th 2	19.7420	19.7447	19.7447	19.7571	19.7571	19.7680	19.7680	19.7659	19.7659	19.7594	19.7571	19.7523 (88)
util rest of house	0.9560	0.9301	0.8803	0.7869	0.6443	0.4211	0.2368	0.2441	0.5008	0.7771	0.9204	0.9630 (89)
MIT 2	19.2369	18.6964	19.0085	19.3389	19.5443	19.6514	19.6652	19.6629	19.6339	19.4093	18.9136	18.6707 (90)
Living area fraction									fLA = Living area / (4) =			0.6626 (91)
MIT	20.0219	19.5915	19.8669	20.1612	20.3595	20.4717	20.4936	20.4923	20.4497	20.2213	19.7738	19.5468 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0219	19.5915	19.8669	20.1612	20.3595	20.4717	20.4936	20.4923	20.4497	20.2213	19.7738	19.5468 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9583	0.9281	0.8830	0.8020	0.6806	0.4811	0.3080	0.3174	0.5590	0.7983	0.9207	0.9615 (94)
Useful gains	542.7862	594.5752	612.5494	583.1954	490.5351	340.5786	209.4686	209.6013	363.6886	490.5631	519.5250	515.8191 (95)
Ext temp.	4.5000	5.1000	6.9000	9.4000	12.3000	15.3000	17.4000	17.4000	14.8000	11.2000	7.4000	4.4000 (96)
Heat loss rate W	1084.4493	1009.9868	903.7316	741.4647	555.3140	352.7398	211.0039	211.3233	386.0860	620.2574	852.5743	1048.2714 (97)
Space heating kWh	402.9973	279.1566	216.6396	113.9539	48.1955	0.0000	0.0000	0.0000	0.0000	96.4925	239.7955	396.1445 (98a)
Space heating requirement - total per year (kWh/year)												1793.3755
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	402.9973	279.1566	216.6396	113.9539	48.1955	0.0000	0.0000	0.0000	0.0000	96.4925	239.7955	396.1445 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1793.3755
Space heating per m2										(98c) / (4) =		36.6519 (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 %)													226.3115 (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	402.9973	279.1566	216.6396	113.9539	48.1955	0.0000	0.0000	0.0000	0.0000	96.4925	239.7955	396.1445 (98)	
Space heating efficiency (main heating system 1)	226.3115	226.3115	226.3115	226.3115	226.3115	0.0000	0.0000	0.0000	0.0000	226.3115	226.3115	226.3115 (210)	
Space heating fuel (main heating system)	178.0720	123.3506	95.7263	50.3527	21.2961	0.0000	0.0000	0.0000	0.0000	42.6371	105.9582	175.0440 (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	205.5817	162.6726	132.1695	81.3495	51.2459	37.2859	36.8535	51.3390	81.1047	135.0653	178.3701	203.4104 (64)	
Efficiency of water heater	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331	191.0331 (216)	
Fuel for water heating, kWh/month	107.6157	85.1542	69.1867	42.5840	26.8257	19.5181	19.2917	26.8744	42.4558	70.7026	93.3713	106.4792 (219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)	
Lighting	14.1322	11.3374	10.2080	7.4788	5.7769	4.7198	5.2699	6.8500	8.8974	11.6739	13.1856	14.5250 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-27.7300	-38.6116	-56.2977	-63.6813	-65.1486	-59.1005	-58.0665	-55.5028	-50.4649	-44.7297	-31.3679	-23.4938 (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													792.4369 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													191.0331
Water heating fuel used													710.0593 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
pump for solar water heating													80.0000 (230g)

Full SAP Calculation Printout



Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	114.0548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-574.1951 (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	1122.3560 (238)

10a. Fuel costs - using BEDF prices (589)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	792.4369	28.4300	225.2898 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	710.0593	28.4300	201.8699 (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)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	114.0548	28.4300	32.4258 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-574.1951	28.4300	-163.2437
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-163.2437 (252)
Total energy cost			319.0858 (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	792.4369	0.1562	123.7500 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	710.0593	0.1481	105.1259 (264)
Space and water heating			228.8759 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	114.0548	0.1443	16.4616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-574.1951	0.1351	-77.5772
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-77.5772 (269)
Total CO2, kg/year			178.8573 (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	792.4369	1.5781	1250.5542 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	710.0593	1.5478	1098.9997 (278)
Space and water heating			2349.5538 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	114.0548	1.5338	174.9411 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-574.1951	1.4994	-860.9300
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-860.9300 (283)
Total Primary energy kWh/year			1784.5889 (286)

B. COMPLIANCE (BREL) REPORT

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 27 Jan 2026 15:36:59

Project Information			
Assessed By	Neil Bradford	Building Type	House, Detached
OCDEA Registration	EES/022901	Assessment Date	2026-01-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	235 m ²
Site Reference	BASE/BELEAN/BEGREEN	Plot Reference	BE GREEN main dwelling
Address	Land Adj to Flint House, ROYSTON, SG8 9SD		

Client Details	
Name	Joe Reader
Company	Croe Architects
Address	Suite 10 , 18 Walsworth Road, Hitchin, SG4 9SP

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	8.52 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.85 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	45.14 kWh _{PE} /m ²		
Dwelling primary energy	38.73 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	44.8 kWh/m ²		
Dwelling fabric energy efficiency	43.3 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.11	GF (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	West GF (1.2)	OK
Rooflights	2.2	1.4	WEST RF 1&2, West (1.4)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	63.5173	0.17	
Exposed wall: Walls (2)	35.1281	0.17	
Exposed wall: Walls (3)	62.4092	0.17	
Exposed wall: Walls (4)	17.8764	0.17	
Ground floor: GF, GF	122	0.11	
Exposed roof: Roof (1)	143.6704	0.11	
Exposed roof: Roof (2)	12.69	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
West GF, Windows	7.232	West	0.7	1.2
West GF, Windows	5.8794	West	0.7	1.2
West GF, Windows	2.712	West	0.7	1.2
West GF, Windows	0.828	West	0.7	1.2
East GF, Windows	1.035	East	0.7	1.2
East GF, Windows	3.164	East	0.7	1.2
East GF, Windows	3.39	East	0.7	1.2
East GF, Windows	5.7838	East	0.7	1.2
North GF, Windows	2.712	North	0.7	1.2
North GF, Windows	2.712	North	0.7	1.2

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
North GF, Windows	1.6905	North	0.7	1.2
South GF, Windows	3.164	South	0.7	1.2
South GF, Windows	7.36	South	0.7	1.2
WEST RF 1&2, Rooflights	1.6898	West	0.7	1.4
EAST RF 3&4, Rooflights	1.6898	East	0.7	1.4
West FF BED, Windows	5.6908	West	0.7	1.2
West FF LAND, Windows	5.0184	West	0.7	1.2
South FF MASTER, Windows	8.8319	South	0.7	1.2
East FF BED, Windows	3.39	East	0.7	1.2
East FF LAND, Windows	4.9852	East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.062	Auto PSI
External wall	E3: Sill	Calculated by person with suitable expertise	0.039 (!)	Auto PSI
External wall	E4: Jamb	Calculated by person with suitable expertise	0.052	Auto PSI
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.075	Auto PSI
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.063	Auto PSI
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.036 (!)	Auto PSI
Roof	R11: Upstands or kerbs of rooflights	Calculated by person with suitable expertise	0.08	Table R2
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.051	Auto PSI
Roof	R5: Ridge (inverted)	Calculated by person with suitable expertise	0.04	Table R2
Roof	R8: Roof to wall (rafter)	Calculated by person with suitable expertise	0.06	Table R2
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.041	Auto PSI
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.07	Auto PSI
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.037 (!)	Auto PSI
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.043	Auto PSI
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.008 (!)	Auto PSI
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	-0.02 (!)	Auto PSI

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	205.1%
Emitter type	Both radiators and underfloor
Flow temperature	55°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 5.0 kW
Commissioning	

Secondary heating system: N/A		
Fuel	N/A	
Efficiency	N/A	
Commissioning		

5 Hot water		
Cylinder/store - type: Cylinder		
Capacity	200 litres	
Declared heat loss	1.43 kWh/day	
Primary pipework insulated	Yes	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

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

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	85 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		

9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	5.5 kWp	
Orientation	North	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
Technology type: Photovoltaic system (2)		
Peak power	0.71 kWp	
Orientation	South	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		

10 Heat networks		
N/A		

11 Supporting documentary evidence		
N/A		

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

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

Date: Tue 27 Jan 2026 15:42:52

Project Information			
Assessed By	Neil Bradford	Building Type	House, Detached
OCDEA Registration	EES/022901	Assessment Date	2026-01-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	49 m ²
Site Reference	BASE/BELEAN/BEGREEN	Plot Reference	BE GREEN annex dwelling
Address	Land Adj to Flint House, ROYSTON, SG8 9SD		

Client Details	
Name	Joe Reader
Company	Croe Architects
Address	Suite 10 , 18 Walsworth Road, Hitchin, SG4 9SP

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	13.46 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	5.36 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	71.89 kWh _{PE} /m ²		
Dwelling primary energy	55.11 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	52.8 kWh/m ²		
Dwelling fabric energy efficiency	46.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.17	Walls (1) (0.17)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.11	GF (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	SOUTH GF (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	61.3868	0.17	
Ground floor: GF, GF	48.93	0.11	
Exposed roof: Roof (1)	55.04	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
SOUTH GF, Windows	0.828	South	0.7	1.2
SOUTH GF, Windows	6.063	South	0.7	1.2
WEST GF, Windows	3.3222	West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.062	Auto PSI
External wall	E3: Sill	Calculated by person with suitable expertise	0.039 (!)	Auto PSI
External wall	E4: Jamb	Calculated by person with suitable expertise	0.052	Auto PSI

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.075	Auto PSI
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.036 (!)	Auto PSI
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.099	Auto PSI
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	Table R2
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.111	Auto PSI
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.051	Auto PSI
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.008 (!)	Auto PSI
Roof	R4: Ridge (vaulted ceiling)	Calculated by person with suitable expertise	-0.02 (!)	Auto PSI

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	203.8%
Emitter type	Both radiators and underfloor
Flow temperature	55°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 5.0 kW
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.43 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat	
Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	85 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.29 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

C. THERMAL BRIDGING

Thermal Bridging

Plot Reference	BASE/BELEAN/BEGREEN		Issued on Date	27/01/2026
Assessment Reference	BE GREEN main dwelling	Plot Type Ref	Detached House	
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD		SAP Version	10.2

SAP Rating	81 B	DER	3.85	TER	8.52
Environmental	96 A	% DER < TER			54.81
CO ₂ Emissions (t/year)	0.82	DFEE	43.26	TFEE	44.85
Compliance Check	See BREL	% DFEE < TFEE			3.53
% DPER < TPER	14.21	DPER	38.73	TPER	45.14

Assessor Details	Mr. Neil Bradford	Assessor ID	T704-0001
Client	Flint House, Joe Reader		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.062	40.22	2.49	Auto PSI
External wall	E3 Sill	Independently assessed	0.039	40.22	1.57	Auto PSI
External wall	E4 Jamb	Independently assessed	0.052	65.38	3.40	Auto PSI
External wall	E5 Ground floor (normal)	Independently assessed	0.075	46.48	3.49	Auto PSI
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.063	46.51	2.93	Auto PSI
External wall	E16 Corner (normal)	Independently assessed	0.036	22.92	0.83	Auto PSI
External roof	R11 Upstands or kerbs of rooflights	Independently assessed	0.080	12.36	0.99	Table R2
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.051	15.70	0.80	Auto PSI
External roof	R5 Ridge (inverted)	Independently assessed	0.040	6.59	0.26	Table R2
External roof	R8 Roof to wall (rafter)	Independently assessed	0.060	5.17	0.31	Table R2
External roof	R1 Head of roof window	Independently assessed	0.041	4.76	0.20	Auto PSI
External wall	E14 Flat roof	Independently assessed	0.070	7.42	0.52	Auto PSI
External roof	R2 Sill of roof window	Independently assessed	0.037	4.76	0.18	Auto PSI
External roof	R3 Jamb of roof window	Independently assessed	0.043	2.86	0.12	Auto PSI
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.008	22.30	0.18	Auto PSI
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	-0.020	20.90	-0.42	Auto PSI

Total: 364.55 W/mK:
Y-Value: 0.03 W/m²K:

Thermal Bridging

Plot Reference	BASE/BELEAN/BEGREEN		Issued on Date	27/01/2026
Assessment Reference	BE GREEN annex dwelling	Plot Type Ref	Detached House	
Plot Address	Land Adj to, Flint House, ROYSTON, SG8 9SD		SAP Version	10.2

SAP Rating	83 B	DER	5.36	TER	13.46
Environmental	96 A	% DER < TER			60.18
CO ₂ Emissions (t/year)	0.24	DFEE	46.58	TFEE	52.78
Compliance Check	See BREL	% DFEE < TFEE			11.74
% DPER < TPER	23.34	DPER	55.11	TPER	71.89

Assessor Details	Mr. Neil Bradford	Assessor ID	T704-0001
Client	Flint House, Joe Reader		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.062	5.77	0.36	Auto PSI
External wall	E3 Sill	Independently assessed	0.039	5.77	0.23	Auto PSI
External wall	E4 Jamb	Independently assessed	0.052	9.64	0.50	Auto PSI
External wall	E5 Ground floor (normal)	Independently assessed	0.075	22.84	1.71	Auto PSI
External wall	E16 Corner (normal)	Independently assessed	0.036	6.25	0.22	Auto PSI
External wall	E18 Party wall between dwellings	Independently assessed	0.099	6.28	0.62	Auto PSI
Party wall	P1 Party wall - Ground floor	Independently assessed	0.080	5.72	0.46	Table R2
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.111	6.40	0.71	Auto PSI
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.051	17.14	0.87	Auto PSI
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.008	6.40	0.05	Auto PSI
External roof	R4 Ridge (vaulted ceiling)	Independently assessed	-0.020	8.57	-0.17	Auto PSI

Total: 100.78 W/mK:
Y-Value: 0.03 W/m²K:

D. PREDICTED ENERGY ASSESSMENT

Predicted Energy Assessment



Land Adj to, Flint House, ROYSTON, SG8 9SD

Dwelling type:

House, Detached

Date of assessment:

27/01/2026

SAP Version:

10.2

Produced by:

Neil Bradford

Total floor area:

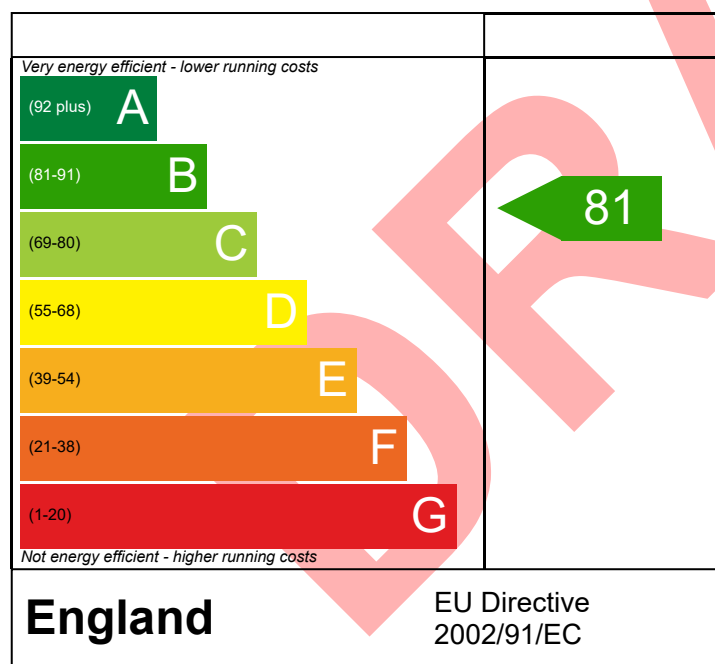
235.41 m²

DRRN:

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

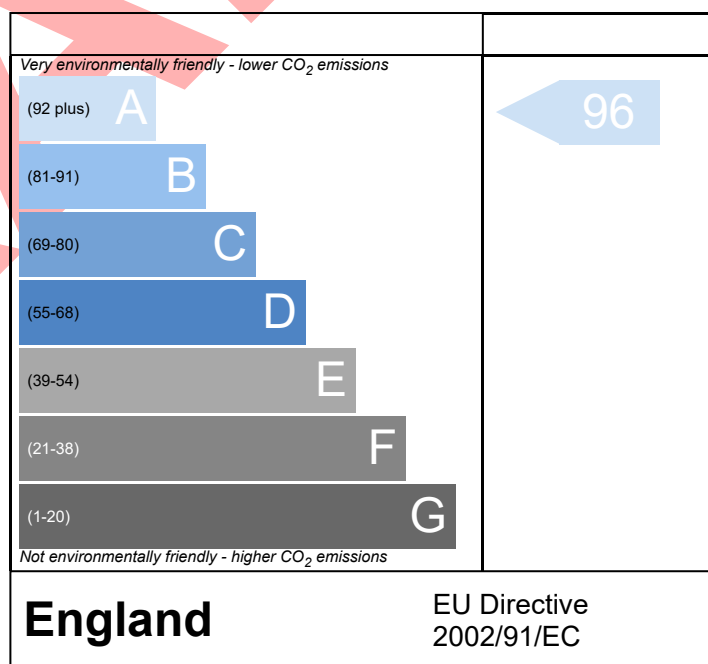
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

Predicted Energy Assessment

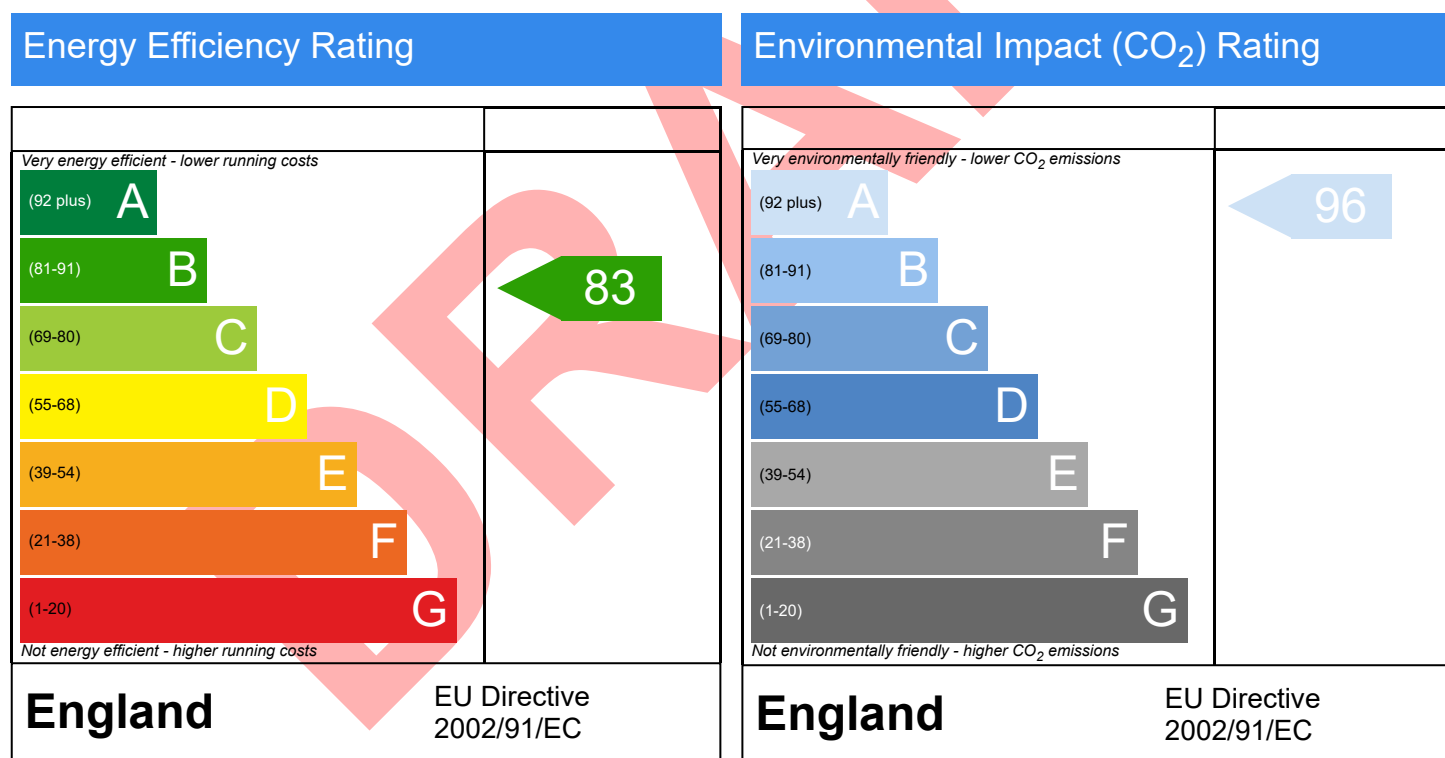


Land Adj to, Flint House, ROYSTON, SG8 9SD

Dwelling type: House, Detached
 Date of assessment: 27/01/2026
 SAP Version: 10.2
 Produced by: Neil Bradford
 Total floor area: 48.93 m²
 DRRN:

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

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



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

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