

Full SAP Calculation Printout



Property Reference	25813		Issued on Date	19/03/2024	
Assessment Reference	00001	Prop Type Ref			
Property	Trevone, Crackington Haven, Bude, Cornwall, EX23 0JQ				
SAP Rating	100 A	DER	-0.01	TER	7.12
Environmental	100 A	% DER < TER	100.14		
CO ₂ Emissions (t/year)	-0.15	DFEE	32.83	TFEE	41.87
Compliance Check	See BREL	% DFEE < TFEE	21.60		
% DPER < TPER	94.25	DPER	2.21	TPER	38.49
Assessor Details	Mr. Benjamin Marsh			Assessor ID	E695-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	667.7970 (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	0 * 10 =											0.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =											0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												2.5000 (17)
Infiltration rate												0.1250 (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) =											0.1250 (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	0.1594	0.1562	0.1531	0.1375	0.1344	0.1187	0.1187	0.1156	0.1250	0.1344	0.1406	0.1469 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.6000 (23c)
Effective ac	0.2814	0.2782	0.2751	0.2595	0.2564	0.2407	0.2407	0.2376	0.2470	0.2564	0.2626	0.2689 (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
Windows (Uw = 1.00)			71.5400	0.9615	68.7885		(27)
South East			2.6000	0.9615	2.5000		(27a)
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000 (28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000 (29a)
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800 (30)
Total net area of external elements Aum(A, m ²)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		137.9251		(33)
Internal Wall 1			331.8500			9.0000	2986.6500 (32c)
Internal Floor 1			119.5000			18.0000	2151.0000 (32d)
Internal Ceiling 1			119.5000			9.0000	1075.5000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	61075.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.8535 (35)
List of Thermal Bridges							

Full SAP Calculation Printout



K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0190	0.8269
E3 Sill	29.3000	0.0160	0.4688
E4 Jamb	92.6000	0.0180	1.6668
E5 Ground floor (normal)	59.2200	0.0540	3.1979
E6 Intermediate floor within a dwelling	51.5000	0.0080	0.4120
E11 Eaves (insulation at rafter level)	41.0000	0.0480	1.9680
E13 Gable (insulation at rafter level)	18.2200	0.0560	1.0203
E16 Corner (normal)	24.5500	0.0400	0.9820
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0680	-0.4590

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0837 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 148.0087 (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	62.0075	61.3188	60.6301	57.1868	56.4981	53.0548	53.0548	52.3661	54.4321	56.4981	57.8755	59.2528 (38)
Average = Sum(39)m / 12 =	210.0162	209.3275	208.6389	205.1955	204.5069	201.0635	201.0635	200.3749	202.4409	204.5069	205.8842	207.2615 (39)
	205.0234											

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7044	0.7021	0.6998	0.6883	0.6859	0.6744	0.6744	0.6721	0.6790	0.6859	0.6906	0.6952 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.6877

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.1295 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for baths	76.6915	75.5390	73.8595	70.6462	68.2749	65.6303	64.1272	65.7939	67.6210	70.4604	73.7428	76.3977 (42a)
Hot water usage for other uses	33.1031	32.6115	31.9191	30.6426	29.6868	28.6269	28.0545	28.7419	29.4905	30.6246	31.9273	32.9912 (42b)
Average daily hot water use (litres/day)	46.6793	44.9819	43.2845	41.5870	39.8896	38.1922	38.1922	39.8896	41.5870	43.2845	44.9819	46.6793 (42c)
	143.8346 (43)											

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy cont	156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682 (44)
Energy content (annual)	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651 (45)
Distribution loss (46)m = 0.15 x (45)m	37.1725	32.7088	34.3657	29.3385	27.8361	24.4293	23.6514	24.9670	25.6544	29.3862	32.1947	36.6548 (46)

Water storage loss:
 Store volume 150.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.9100 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.0314 (55)

Total storage loss	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Primary loss	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734 (56)
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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (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)
FV 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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 3039.4191 (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
 126.5876 112.4168 120.3659 107.7969 105.8921 96.9148 96.6159 99.5322 99.6304 109.3280 114.1281 125.4400 (65)

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

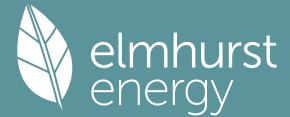
Metabolic gains (Table 5), Watts

(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	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3813	255.0650	230.3813	238.0606	230.3813	238.0606	230.3813	230.3813	238.0606	230.3813	238.0606	230.3813 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	456.7566	461.4963	449.5524	424.1253	392.0281	361.8612	341.7079	336.9682	348.9121	374.3392	406.4365	436.6033 (68)
Pumps, fans	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Total internal gains	170.1447	167.2868	161.7821	149.7179	142.3281	134.6039	129.8600	133.7799	138.3755	146.9463	158.5113	168.6022 (72)
	927.2252	953.7908	911.6585	881.8465	834.6801	804.4685	771.8919	771.0720	795.2909	821.6095	872.9511	905.5294 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.6600	11.2829	0.5700	0.8000	0.7700	45.1392 (75)
Southeast	9.0900	36.7938	0.5700	0.8000	0.7700	105.6908 (77)
Southwest	11.2500	36.7938	0.5700	0.8000	0.7700	130.8054 (79)
Northwest	38.5400	11.2829	0.5700	0.8000	0.7700	137.4144 (81)
Southeast	2.6000	37.7778	0.5700	0.8000	1.0000	40.3104 (82)

Full SAP Calculation Printout



Solar gains	459.3601	850.4178	1340.5433	1951.8289	2447.4783	2543.5833	2405.0082	2018.5730	1549.9942	987.9494	562.6692	385.0064 (83)
Total gains	1386.5854	1804.2086	2252.2018	2833.6754	3282.1584	3348.0518	3176.9001	2789.6450	2345.2851	1809.5588	1435.6203	1290.5359 (84)

7. Mean internal temperature (heating season)

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

21.0000 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil, _m (see Table 9a)												
tau	80.7808	81.0466	81.3141	82.6786	82.9570	84.3777	84.3777	84.6677	83.8037	82.9570	82.4021	81.8545
alpha	6.3854	6.4031	6.4209	6.5119	6.5305	6.6252	6.6252	6.6445	6.5869	6.5305	6.4935	6.4570
util living area	0.9984	0.9914	0.9567	0.8033	0.5724	0.3839	0.2784	0.3303	0.5875	0.9262	0.9943	0.9990 (86)
Living	20.2137	20.4017	20.6488	20.8803	20.9444	20.9526	20.9530	20.9531	20.9462	20.7951	20.4521	20.1883
Non living	19.3898	19.6312	19.9420	20.2197	20.2857	20.3030	20.3033	20.3055	20.2943	20.1327	19.7050	19.3640
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	20.5978	20.4017	20.6488	20.8803	20.9444	20.9526	20.9530	20.9531	20.9462	20.7951	20.4521	20.3018 (87)
Th 2	20.3369	20.3390	20.3410	20.3512	20.3533	20.3635	20.3635	20.3656	20.3594	20.3533	20.3492	20.3451 (88)
util rest of house	0.9980	0.9893	0.9470	0.7738	0.5347	0.3459	0.2382	0.2848	0.5360	0.9055	0.9926	0.9987 (89)
MIT 2	19.9593	19.6312	19.9420	20.2197	20.2857	20.3030	20.3033	20.3055	20.2943	20.1327	19.7050	19.5408 (90)
Living area fraction	20.1837	19.9019	20.1903	20.4518	20.5171	20.5313	20.5316	20.5330	20.5234	20.3655	19.9675	19.8082 (91)
MIT	20.1837	19.9019	20.1903	20.4518	20.5171	20.5313	20.5316	20.5330	20.5234	20.3655	19.9675	19.8082 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1837	19.9019	20.1903	20.4518	20.5171	20.5313	20.5316	20.5330	20.5234	20.3655	19.9675	19.8082 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9978	0.9876	0.9445	0.7786	0.5444	0.3559	0.2488	0.2968	0.5493	0.9059	0.9913	0.9984 (94)
Useful gains	1383.6014	1781.7571	2127.1876	2206.2728	1786.7246	1191.7388	790.4436	827.9747	1288.3063	1639.2851	1423.1852	1288.4792 (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	3335.8269	3140.3205	2856.3375	2370.3836	1803.1649	1192.5616	790.5027	828.1569	1300.3509	1997.1061	2649.2226	3234.9839 (97)
Space heating kWh	1452.4558	912.9546	542.4875	118.1597	12.2316	0.0000	0.0000	0.0000	0.0000	266.2188	882.7470	1448.1995 (98a)
Space heating requirement - total per year (kWh/year)												5635.4545
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	1452.4558	912.9546	542.4875	118.1597	12.2316	0.0000	0.0000	0.0000	0.0000	266.2188	882.7470	1448.1995 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5635.4545
Space heating per m ²										(98c) / (4) =		18.9020 (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 %)												407.2725 (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	1452.4558	912.9546	542.4875	118.1597	12.2316	0.0000	0.0000	0.0000	0.0000	266.2188	882.7470	1448.1995 (98)
Space heating efficiency (main heating system 1)	407.2725	407.2725	407.2725	407.2725	407.2725	0.0000	0.0000	0.0000	0.0000	407.2725	407.2725	407.2725 (210)
Space heating fuel (main heating system)	356.6300	224.1631	133.2001	29.0124	3.0033	0.0000	0.0000	0.0000	0.0000	65.3663	216.7460	355.5849 (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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (64)
Efficiency of water heater (217)m	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782 (216)
Fuel for water heating, kWh/month	158.6012	140.2299	148.8084	130.3361	126.0270	113.2081	111.4265	116.0167	117.4823	131.4351	140.3014	156.7949 (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	97.8414	88.3729	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	94.6852	97.8414	94.6852	97.8414 (231)
Lighting	57.7463	46.3263	41.7117	30.5597	23.6052	19.2857	21.5335	27.9900	36.3563	47.7014	53.8786	59.3513 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-143.9073	-229.1447	-362.9403	-435.0756	-489.4425	-464.6506	-459.4817	-424.2867	-359.9188	-276.6626	-167.0799	-121.2110 (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	-6.3522	-21.5952	-64.0984	-137.2405	-217.6058	-230.4905	-226.4728	-175.0352	-109.4705	-43.8750	-11.1495	-4.5306 (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												1383.7062 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

Full SAP Calculation Printout



Efficiency of water heater	191.0782
Water heating fuel used	1590.6676 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140)	
mechanical ventilation fans (SFP = 1.4140)	1152.0032 (230a)
Total electricity for the above, kWh/year	1152.0032 (231)
Electricity for lighting (calculated in Appendix L)	466.0460 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-5181.7182 (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	-589.2951 (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	1383.7062	0.1579	218.5004 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1590.6676	0.1410	224.2284 (264)
Space and water heating			442.7288 (265)
Pumps, fans and electric keep-hot	1152.0032	0.1387	159.7971 (267)
Energy for lighting	466.0460	0.1443	67.2648 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3933.8018	0.1330	-523.2755
PV Unit electricity exported	-1247.9164	0.1186	-148.0534
Total			-671.3288 (269)
Total CO2, kg/year			-1.5381 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.0100 (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	1383.7062	1.5845	2192.4853 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1590.6676	1.5212	2419.7880 (278)
Space and water heating			4612.2733 (279)
Pumps, fans and electric keep-hot	1152.0032	1.5128	1742.7505 (281)
Energy for lighting	466.0460	1.5338	714.8369 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3933.8018	1.4915	-5867.4278
PV Unit electricity exported	-1247.9164	0.4351	-543.0194
Total			-6410.4472 (283)
Total Primary energy kWh/year			659.4135 (286)
Dwelling Primary energy Rate (DPER)			2.2100 (287)

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

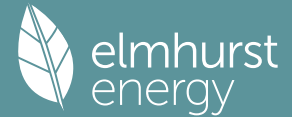
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	667.7970 (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)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0599 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3099 (18)
Number of sides sheltered	0 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3099 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate												
Effective ac	0.3951	0.3874	0.3796	0.3409	0.3331	0.2944	0.2944	0.2867	0.3099	0.3331	0.3486	0.3641 (22b)
	0.5781	0.5750	0.5721	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5608	0.5663 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opening Type (Uw = 1.20)			71.5400	1.1450	81.9160		(27)
South East			2.6000	1.9373	5.0369		(27a)
Ground Floor			178.6400	0.1300	23.2232		(28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1800	31.5684		(29a)
Warm Roof	212.5200	2.6000	209.9200	0.1100	23.0912		(30)
Total net area of external elements Aum(A, m2)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 164.8357		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							204.8535 (35)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 204.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0500	2.1760
E3 Sill	29.3000	0.0500	1.4650
E4 Jamb	92.6000	0.0500	4.6300
E5 Ground floor (normal)	59.2200	0.1600	9.4752
E6 Intermediate floor within a dwelling	51.5000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	41.0000	0.0400	1.6400
E13 Gable (insulation at rafter level)	18.2200	0.0800	1.4576
E16 Corner (normal)	24.5500	0.0900	2.2095
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0900	-0.6075

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.4458 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 187.2815 (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	127.3888	126.7209	126.0661	122.9907	122.4153	119.7367	119.7367	119.2407	120.7685	122.4153	123.5793	124.7963 (38)
Average = Sum(39)m / 12 =	314.6704	314.0024	313.3476	310.2722	309.6968	307.0183	307.0183	306.5222	308.0500	309.6968	310.8609	312.0778 (39)
												310.2695

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0554	1.0532	1.0510	1.0407	1.0388	1.0298	1.0298	1.0281	1.0332	1.0388	1.0427	1.0467 (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													3.1295 (42)
Hot water usage for mixer showers	76.6915	75.5390	73.8595	70.6462	68.2749	65.6303	64.1272	65.7939	67.6210	70.4604	73.7428	76.3977 (42a)	
Hot water usage for baths	33.1031	32.6115	31.9191	30.6426	29.6868	28.6269	28.0545	28.7419	29.4905	30.6246	31.9273	32.9912 (42b)	
Hot water usage for other uses	46.6793	44.9819	43.2845	41.5870	39.8896	38.1922	38.1922	39.8896	41.5870	43.2845	44.9819	46.6793 (42c)	
Average daily hot water use (litres/day)													143.8346 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682 (44)	
Energy content (annual)	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2389.0621

Distribution loss (46)m = 0.15 x (45)m	37.1725	32.7088	34.3657	29.3385	27.8361	24.4293	23.6514	24.9670	25.6544	29.3862	32.1947	36.6548 (46)	
Water storage loss:													150.0000 (47)
Store volume													1.3938 (48)

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

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)

If cylinder contains dedicated solar storage 23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 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 0.0000 (61)

Total heat required for water heating calculated for each month 294.4114 260.1442 275.6994 240.6818 232.1692 207.9539 204.2708 213.0417 216.1210 242.5029 259.7232 290.9600 (62)

WWHRS -35.0602 -31.0075 -32.4693 -26.8858 -25.0566 -21.4411 -20.0976 -21.3718 -22.1838 -26.1523 -29.6274 -34.4109 (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 259.3512 229.1367 243.2302 213.7960 207.1126 186.5128 184.1731 191.6699 193.9371 216.3506 230.0959 256.5491 (64)

Total per year (kWh/year) = Sum(64)m = 2611.9151 (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 119.6749 106.1730 113.4532 101.1071 98.9794 90.2251 89.7031 92.6195 92.9407 102.4153 107.4384 118.5273 (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	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	230.3813	255.0650	230.3813	238.0606	230.3813	238.0606	230.3813	230.3813	238.0606	230.3813	238.0606	230.3813 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7566	461.4963	449.5524	424.1253	392.0281	361.8612	341.7079	336.9682	348.9121	374.3392	406.4365	436.6033 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476 (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)	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Water heating gains (Table 5)	160.8534	157.9955	152.4908	140.4266	133.0368	125.3127	120.5687	124.4886	129.0842	137.6550	149.2200	159.3109 (72)
Total internal gains	920.9339	947.4995	905.3672	875.5552	828.3888	795.1772	762.6006	761.7807	785.9997	815.3182	866.6598	899.2382 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	12.6600	11.2829	0.6300	0.7000	0.7700	43.6544 (75)						
Southeast	9.0900	36.7938	0.6300	0.7000	0.7700	102.2141 (77)						
Southwest	11.2500	36.7938	0.6300	0.7000	0.7700	126.5026 (79)						
Northwest	38.5400	11.2829	0.6300	0.7000	0.7700	132.8941 (81)						
Southeast	2.6000	37.7778	0.6300	0.7000	1.0000	38.9844 (82)						
Solar gains	444.2496	822.4436	1296.4465	1887.6240	2366.9691	2459.9128	2325.8961	1952.1726	1499.0075	955.4510	544.1603	372.3418 (83)
Total gains	1365.1835	1769.9431	2201.8137	2763.1792	3195.3579	3255.0900	3088.4967	2713.9533	2285.0072	1770.7692	1410.8201	1271.5799 (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	53.9145	54.0292	54.1421	54.6787	54.7803	55.2582	55.2582	55.3477	55.0732	54.7803	54.5752	54.3624
alpha	4.5943	4.6019	4.6095	4.6452	4.6520	4.6839	4.6839	4.6898	4.6715	4.6520	4.6383	4.6242
util living area	0.9985	0.9948	0.9814	0.9227	0.7778	0.5798	0.4322	0.5077	0.7926	0.9712	0.9962	0.9989 (86)
MIT	19.3342	19.5891	19.9792	20.4827	20.8304	20.9666	20.9931	20.9861	20.8648	20.3551	19.7486	19.2964 (87)
Th 2	20.0374	20.0392	20.0410	20.0496	20.0512	20.0586	20.0586	20.0600	20.0557	20.0512	20.0479	20.0446 (88)
util rest of house	0.9981	0.9933	0.9760	0.9014	0.7267	0.5034	0.3423	0.4095	0.7232	0.9595	0.9950	0.9986 (89)
MIT 2	18.0658	18.3931	18.8898	19.5158	19.9055	20.0381	20.0560	20.0542	19.9552	19.3743	18.6042	18.0223 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.5115	18.8133	19.2726	19.8556	20.2305	20.3643	20.3853	20.3816	20.2748	19.7189	19.0063	18.4700 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5115	18.8133	19.2726	19.8556	20.2305	20.3643	20.3853	20.3816	20.2748	19.7189	19.0063	18.4700 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9906	0.9703	0.8963	0.7370	0.5289	0.3739	0.4438	0.7409	0.9542	0.9929	0.9978 (94)
Useful gains	1361.1087	1753.3734	2136.4910	2476.7193	2355.1178	1721.7392	1154.6755	1204.4645	1692.8741	1689.6716	1400.8189	1268.8157 (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	4471.9393	4368.8230	4002.2540	3399.2149	2641.8601	1769.7575	1162.1520	1220.4603	1902.1531	2824.1040	3701.2138	4453.3463 (97)
Space heating kWh	2314.4580	1757.5821	1388.1277	664.1968	213.3363	0.0000	0.0000	0.0000	0.0000	844.0178	1656.2843	2369.2908 (98a)
Space heating requirement - total per year (kWh/year)												11207.2937
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	2314.4580	1757.5821	1388.1277	664.1968	213.3363	0.0000	0.0000	0.0000	0.0000	844.0178	1656.2843	2369.2908 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11207.2937
Space heating per m ²												(98c) / (4) = 37.5907 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	2314.4580	1757.5821	1388.1277	664.1968	213.3363	0.0000	0.0000	0.0000	0.0000	844.0178	1656.2843	2369.2908 (98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	2507.5384	1904.2060	1503.9303	719.6065	231.1336	0.0000	0.0000	0.0000	0.0000	914.4288	1794.4576	2566.9456 (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 (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	259.3512	229.1367	243.2302	213.7960	207.1126	186.5128	184.1731	191.6699	193.9371	216.3506	230.0959	256.5491 (64)
Efficiency of water heater (217)m	87.8022	87.6598	87.3315	86.4265	84.1263	79.8000	79.8000	79.8000	79.8000	86.8026	87.5950	79.8000 (216)
Fuel for water heating, kWh/month	295.3813	261.3932	278.5137	247.3733	246.1926	233.7253	230.7934	240.1878	243.0290	249.2445	262.6816	292.0901 (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	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	47.8687	38.4020	34.5768	25.3324	19.5675	15.9868	17.8501	23.2023	30.1374	39.5420	44.6626	49.1991	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-132.1346	-170.9847	-225.6643	-232.0647	-233.0351	-211.1842	-207.9912	-203.9899	-195.6357	-183.7409	-139.4081	-116.0618	(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	-129.4296	-263.2972	-507.9013	-741.8859	-961.9494	-960.2176	-949.3974	-812.7898	-607.6341	-369.8066	-170.4173	-103.1081	(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														12142.2467 (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														3080.6058 (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)														386.3276 (232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation														-8829.7296 (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														6865.4506 (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	12142.2467	0.2100	2549.8718 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3080.6058	0.2100	646.9272 (264)
Space and water heating			3196.7990 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	386.3276	0.1443	55.7590 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2251.8952	0.1365	-307.4690
PV Unit electricity exported	-6577.8344	0.1267	-833.5804
Total			-1141.0494 (269)
Total CO2, kg/year			2123.4379 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.1200 (273)

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

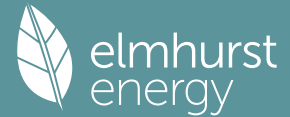
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	12142.2467	1.1300	13720.7388 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3080.6058	1.1300	3481.0845 (278)
Space and water heating			17201.8233 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	386.3276	1.5338	592.5622 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2251.8952	1.5047	-3388.4872
PV Unit electricity exported	-6577.8344	0.4652	-3060.0451
Total			-6448.5324 (283)
Total Primary energy kWh/year			11475.9540 (286)
Target Primary Energy Rate (TPER)			38.4900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 667.7970 (5)

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2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.0599 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												2.5000	(17)
Infiltration rate												0.1849	(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) =	0.1849 (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)
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	0.2357	0.2311	0.2265	0.2034	0.1988	0.1757	0.1757	0.1710	0.1849	0.1988	0.2080	0.2173	(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	0.5278	0.5267	0.5257	0.5207	0.5198	0.5154	0.5154	0.5146	0.5171	0.5198	0.5216	0.5236	(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						
Windows (Uw = 1.00)			71.5400	0.9615	68.7885			(27)					
South East			2.6000	0.9615	2.5000			(27a)					
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000	(28a)					
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000	(29a)					
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800	(30)					
Total net area of external elements Aum(A, m2)			638.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	137.9251		(33)					
Internal Wall 1			331.8500			9.0000	2986.6500	(32c)					
Internal Floor 1			119.5000			18.0000	2151.0000	(32d)					
Internal Ceiling 1			119.5000			9.0000	1075.5000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		61075.0300	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							204.8535	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				43.5200	0.0190	0.8269							
E3 Sill				29.3000	0.0160	0.4688							
E4 Jamb				92.6000	0.0180	1.6668							
E5 Ground floor (normal)				59.2200	0.0540	3.1979							
E6 Intermediate floor within a dwelling				51.5000	0.0080	0.4120							
E11 Eaves (insulation at rafter level)				41.0000	0.0480	1.9680							
E13 Gable (insulation at rafter level)				18.2200	0.0560	1.0203							
E16 Corner (normal)				24.5500	0.0400	0.9820							
E17 Corner (inverted - internal area greater than external area)				6.7500	-0.0680	-0.4590							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0837	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	148.0087 (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	
	116.3102	116.0724	115.8394	114.7446	114.5397	113.5862	113.5862	113.4096	113.9535	114.5397	114.9541	115.3873	(38)
Heat transfer coeff	264.3190	264.0812	263.8481	262.7533	262.5485	261.5950	261.5950	261.4184	261.9622	262.5485	262.9628	263.3961	(39)
Average = Sum(39)m / 12 =												262.7523	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8866	0.8858	0.8850	0.8813	0.8806	0.8774	0.8774	0.8768	0.8787	0.8806	0.8820	0.8835	(40)
HLP (average)												0.8813	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1295 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													33.1031 (42b)
Hot water usage for other uses													46.6793 (42c)
Average daily hot water use (litres/day)													73.1275 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	79.7824	77.5934	75.2036	72.2297	69.5764	66.8191	66.2466	68.6315	71.0775	73.9090	76.9092	79.6705	(44)
Energy conte	126.3558	110.4919	115.5852	98.8788	93.6632	82.1619	80.1196	84.9802	87.6457	100.2939	109.5713	124.7448	(45)
Energy content (annual)													Total = Sum(45)m = 1214.4923
Distribution loss (46)m = 0.15 x (45)m													0.0000 (46)
Water storage loss:													
Total storage loss													0.0000 (56)
If cylinder contains dedicated solar storage													0.0000 (57)
Primary loss													0.0000 (59)
Combi loss													0.0000 (61)

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Total heat required for water heating calculated for each month												
	107.4025	93.9181	98.2474	84.0470	79.6138	69.8376	68.1016	72.2332	74.4988	85.2498	93.1356	106.0330 (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	107.4025	93.9181	98.2474	84.0470	79.6138	69.8376	68.1016	72.2332	74.4988	85.2498	93.1356	106.0330 (64)
	Total per year (kWh/year) = Sum(64)m =										1032.3184 (64)	
12Total per year (kWh/year)												1032 (64)
Electric shower(s)	61.4171	54.7232	59.7556	57.0240	58.0941	55.4161	57.2633	58.0941	57.0240	59.7556	58.6320	61.4171 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										698.6163 (64a)	
Heat gains from water heating, kWh/month	42.2049	37.1603	39.5007	35.2678	34.4270	31.3134	31.3412	32.5818	32.8807	36.2513	37.9419	41.8625 (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	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	230.3813	255.0650	230.3813	238.0606	230.3813	238.0606	230.3813	230.3813	238.0606	230.3813	238.0606	230.3813 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7566	461.4963	449.5524	424.1253	392.0281	361.8612	341.7079	336.9682	348.9121	374.3392	406.4365	436.6033 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476	38.6476 (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)	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Water heating gains (Table 5)	56.7270	55.2981	53.0924	48.9830	46.2728	43.4909	42.1253	43.7928	45.6677	48.7249	52.6971	56.2669 (72)
Total internal gains	813.8076	841.8021	802.9688	781.1116	738.6248	713.3554	684.1572	681.0849	702.5831	723.3881	767.1369	793.1941 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast		12.6600	11.2829	0.5700	0.8000	0.7700	45.1392 (75)					
Southeast		9.0900	36.7938	0.5700	0.8000	0.7700	105.6908 (77)					
Southwest		11.2500	36.7938	0.5700	0.8000	0.7700	130.8054 (79)					
Northwest		38.5400	11.2829	0.5700	0.8000	0.7700	137.4144 (81)					
Southeast		2.6000	37.7778	0.5700	0.8000	1.0000	40.3104 (82)					
Solar gains	459.3601	850.4178	1340.5433	1951.8289	2447.4783	2543.5833	2405.0082	2018.5730	1549.9942	987.9494	562.6692	385.0064 (83)
Total gains	1273.1677	1692.2199	2143.5120	2732.9405	3186.1031	3256.9387	3089.1654	2699.6579	2252.5773	1711.3375	1329.8060	1178.2006 (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	64.1849	64.2427	64.2994	64.5674	64.6177	64.8533	64.8533	64.8971	64.7623	64.6177	64.5159	64.4098
alpha	5.2790	5.2828	5.2866	5.3045	5.3078	5.3236	5.3236	5.3265	5.3175	5.3078	5.3011	5.2940
util living area	0.9990	0.9954	0.9789	0.8976	0.7127	0.5067	0.3714	0.4421	0.7369	0.9670	0.9970	0.9993 (86)
MIT	19.6039	19.8591	20.2322	20.6770	20.9240	20.9894	20.9983	20.9960	20.9343	20.5215	19.9640	19.5561 (87)
Th 2	20.1789	20.1796	20.1803	20.1834	20.1840	20.1867	20.1867	20.1872	20.1857	20.1840	20.1828	20.1816 (88)
util rest of house	0.9987	0.9941	0.9732	0.8735	0.6640	0.4452	0.3034	0.3656	0.6706	0.9547	0.9960	0.9991 (89)
MIT 2	18.8791	19.1341	19.5031	19.9266	20.1342	20.1817	20.1862	20.1859	20.1485	19.7914	19.2418	18.8334 (90)
Living area fraction										fLA = Living area / (4) =		0.3514 (91)
MIT	19.1338	19.3888	19.7593	20.1903	20.4117	20.4655	20.4716	20.4705	20.4246	20.0479	19.4956	19.0873 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1338	19.3888	19.7593	20.1903	20.4117	20.4655	20.4716	20.4705	20.4246	20.0479	19.4956	19.0873 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9925	0.9695	0.8738	0.6781	0.4665	0.3273	0.3925	0.6912	0.9522	0.9949	0.9988 (94)	
Useful gains	1270.8980	1679.4648	2078.2163	2387.9586	2160.4844	1519.4881	1010.9855	1059.5763	1556.9022	1629.4775	1322.9893	1176.7825 (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	3920.8509	3826.2274	3498.4413	2966.5516	2287.2471	1534.3779	1012.7845	1064.1152	1656.8137	2480.5369	3259.5751	3921.2630 (97)	
Space heating kWh	1971.5650	1442.6245	1056.6474	416.5870	94.3115	0.0000	0.0000	0.0000	0.0000	633.1882	1394.3418	2041.8935 (98a)	
Space heating requirement - total per year (kWh/year)												9051.1588	
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	1971.5650	1442.6245	1056.6474	416.5870	94.3115	0.0000	0.0000	0.0000	0.0000	633.1882	1394.3418	2041.8935 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												9051.1588	
Space heating per m ²												(98c) / (4) =	30.3588 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2458.9926	1935.8027	1986.7797	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9571	0.9797	0.9607	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2353.4419	1896.5773	1908.6428	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3661.0516	3470.8891	3024.7835	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	941.4790	1171.2880	830.4087	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	235.3697	292.8220	207.6022	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												735.7939 (107)
Energy for space cooling												30.3588 (99)
Total												2.4679 (108)
Fabric Energy Efficiency (DFEE)												32.8267 (109)
												32.8 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 667.7970 (5)

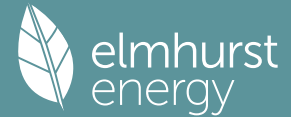
2. Ventilation rate

	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) = 0.0599 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3099 (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) = 0.3099 (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	0.3951, 0.3874, 0.3796, 0.3409, 0.3331, 0.2944, 0.2944, 0.2867, 0.3099, 0.3331, 0.3486, 0.3641 (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	0.5781, 0.5750, 0.5721, 0.5581, 0.5555, 0.5433, 0.5433, 0.5411, 0.5480, 0.5555, 0.5608, 0.5663 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opening Type (Uw = 1.20)			71.5400	1.1450	81.9160		(27)
South East			2.6000	1.9373	5.0369		(27a)
Ground Floor			178.6400	0.1300	23.2232		(28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1800	31.5684		(29a)
Warm Roof	212.5200	2.6000	209.9200	0.1100	23.0912		(30)
Total net area of external elements Aum(A, m2)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 164.8357		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							204.8535 (35)
List of Thermal Bridges				Length	Psi-value	Total	
K1 Element				43.5200	0.0500	2.1760	
E2 Other lintels (including other steel lintels)				29.3000	0.0500	1.4650	
E3 Sill				92.6000	0.0500	4.6300	
E4 Jamb				59.2200	0.1600	9.4752	
E5 Ground floor (normal)				51.5000	0.0000	0.0000	
E6 Intermediate floor within a dwelling				41.0000	0.0400	1.6400	
E11 Eaves (insulation at rafter level)				18.2200	0.0800	1.4576	
E13 Gable (insulation at rafter level)				24.5500	0.0900	2.2095	
E16 Corner (normal)				6.7500	-0.0900	-0.6075	
E17 Corner (inverted - internal area greater than external area)							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						22.4458 (36)	
Point Thermal bridges						(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) = 187.2815 (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	127.3888	126.7209	126.0661	122.9907	122.4153	119.7367	119.7367	119.2407	120.7685	122.4153	123.5793	124.7963 (38)
Heat transfer coeff	314.6704	314.0024	313.3476	310.2722	309.6968	307.0183	307.0183	306.5222	308.0500	309.6968	310.8609	312.0778 (39)
Average = Sum(39)m / 12 =	310.2695											
HLP	1.0554	1.0532	1.0510	1.0407	1.0388	1.0298	1.0298	1.0281	1.0332	1.0388	1.0427	1.0467 (40)
HLP (average)	1.0407											
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.1295 (42)											
Hot water usage for mixer showers	0.0000 (42a)											
Hot water usage for baths	33.1031 (42b)											
Hot water usage for other uses	46.6793 (42c)											
Average daily hot water use (litres/day)	73.1275 (43)											
Daily hot water use	79.7824	77.5934	75.2036	72.2297	69.5764	66.8191	66.2466	68.6315	71.0775	73.9090	76.9092	79.6705 (44)
Energy content (annual)	126.3558	110.4919	115.5852	98.8788	93.6632	82.1619	80.1196	84.9802	87.6457	100.2939	109.5713	124.7448 (45)
Distribution loss (46)m = 0.15 x (45)m	1214.4923											
Water storage loss:	0.0000 (46)											
Total storage loss	0.0000 (56)											
If cylinder contains dedicated solar storage	0.0000 (57)											
Primary loss	0.0000 (59)											
Combi loss	0.0000 (61)											
Total heat required for water heating calculated for each month	107.4025	93.9181	98.2474	84.0470	79.6138	69.8376	68.1016	72.2332	74.4988	85.2498	93.1356	106.0330 (62)
WWHRS	0.0000 (63a)											
FV diverter	0.0000 (63b)											
Solar input	0.0000 (63c)											
FGHRS	0.0000 (63d)											
Output from w/h	107.4025	93.9181	98.2474	84.0470	79.6138	69.8376	68.1016	72.2332	74.4988	85.2498	93.1356	106.0330 (64)
Total per year (kWh/year)	1032.3184 (64)											
Electric shower(s)	61.4171	54.7232	59.7556	57.0240	58.0941	55.4161	57.2633	58.0941	57.0240	59.7556	58.6320	61.4171 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m	698.6163 (64a)											
Heat gains from water heating, kWh/month	42.2049	37.1603	39.5007	35.2678	34.4270	31.3134	31.3412	32.5818	32.8807	36.2513	37.9419	41.8625 (65)

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

Metabolic gains (Table 5), Watts	156.4756 (66)											
(66)m	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756	156.4756 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	230.3813 (67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7566 (68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.6476 (69)											
Pumps, fans	0.0000 (70)											
Losses e.g. evaporation (negative values) (Table 5)	-125.1805 (71)											
Water heating gains (Table 5)	56.7270 (72)											
Total internal gains	813.8076	841.8021	802.9688	781.1116	738.6248	713.3554	684.1572	681.0849	702.5831	723.3881	767.1369	793.1941 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	12.6600	11.2829	0.6300	0.7000	0.7700	43.6544 (75)		
Southeast	9.0900	36.7938	0.6300	0.7000	0.7700	102.2141 (77)		
Southwest	11.2500	36.7938	0.6300	0.7000	0.7700	126.5026 (79)		
Northwest	38.5400	11.2829	0.6300	0.7000	0.7700	132.8941 (81)		
Southeast	2.6000	37.7778	0.6300	0.7000	1.0000	38.9844 (82)		

Solar gains	444.2496	822.4436	1296.4465	1887.6240	2366.9691	2459.9128	2325.8961	1952.1726	1499.0075	955.4510	544.1603	372.3418 (83)
Total gains	1258.0572	1664.2456	2099.4152	2668.7356	3105.5939	3173.2682	3010.0533	2633.2575	2201.5906	1678.8391	1311.2972	1165.5359 (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)	0.9989 (86)											
tau	53.9145	54.0292	54.1421	54.6787	54.7803	55.2582	55.2582	55.3477	55.0732	54.7803	54.5752	54.3624
alpha	4.5943	4.6019	4.6095	4.6452	4.6520	4.6839	4.6839	4.6898	4.6715	4.6520	4.6383	4.6242
util living area	0.9989	0.9960	0.9845	0.9307	0.7907	0.5925	0.4429	0.5218	0.8089	0.9763	0.9972	0.9993 (86)

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MIT	19.2886	19.5449	19.9389	20.4544	20.8176	20.9635	20.9924	20.9845	20.8518	20.3205	19.7066	19.2511 (87)
Th 2	20.0374	20.0392	20.0410	20.0496	20.0512	20.0586	20.0586	20.0600	20.0557	20.0512	20.0479	20.0446 (88)
util rest of house												
	0.9986	0.9948	0.9799	0.9110	0.7406	0.5153	0.3510	0.4215	0.7414	0.9664	0.9963	0.9990 (89)
MIT 2	18.4555	18.7125	19.1045	19.6080	19.9281	20.0410	20.0563	20.0549	19.9686	19.4908	18.8811	18.4234 (90)
Living area fraction									fLA = Living area / (4) =			0.3514 (91)
MIT	18.7482	19.0050	19.3977	19.9054	20.2407	20.3652	20.3853	20.3815	20.2790	19.7823	19.1712	18.7142 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7482	19.0050	19.3977	19.9054	20.2407	20.3652	20.3853	20.3815	20.2790	19.7823	19.1712	18.7142 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9980	0.9931	0.9759	0.9075	0.7513	0.5412	0.3833	0.4566	0.7590	0.9628	0.9950	0.9986 (94)
Useful gains	1255.5692	1652.7072	2048.8486	2421.7828	2333.3167	1717.2700	1153.8354	1202.4216	1670.9717	1616.4191	1304.7778	1163.9086 (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	4546.4301	4428.9929	4041.4638	3414.6726	2645.0140	1770.0071	1162.1415	1220.4217	1903.4267	2843.7308	3752.4482	4529.5727 (97)
Space heating kWh	2448.4006	1865.6640	1482.5057	714.8806	231.9028	0.0000	0.0000	0.0000	0.0000	913.1199	1762.3227	2504.0540 (98a)
Space heating requirement - total per year (kWh/year)												11922.8503
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	2448.4006	1865.6640	1482.5057	714.8806	231.9028	0.0000	0.0000	0.0000	0.0000	913.1199	1762.3227	2504.0540 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11922.8503
Space heating per m2												(98c) / (4) = 39.9908 (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	2885.9718	2271.9353	2329.5691	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8987	0.9430	0.9058	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2593.5892	2142.4716	2110.1138	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3564.4130	3379.5248	2948.1307	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	698.9931	920.3676	623.4846	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	174.7483	230.0919	155.8711	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												560.7113 (107)
Energy for space heating												39.9908 (99)
Energy for space cooling												1.8807 (108)
Total												41.8715 (109)
Fabric Energy Efficiency (TFEE)												41.9 (109)

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

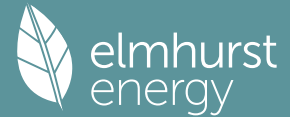
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	667.7970 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1250 (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) = 0.1250 (21)

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	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													
	0.1594	0.1562	0.1531	0.1375	0.1344	0.1187	0.1187	0.1156	0.1250	0.1344	0.1406	0.1469	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.5000 (23b)
													75.6000 (23c)
Effective ac	0.2814	0.2782	0.2751	0.2595	0.2564	0.2407	0.2407	0.2376	0.2470	0.2564	0.2626	0.2689	(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		
Windows (Uw = 1.00)			71.5400	0.9615	68.7885			(27)	
South East			2.6000	0.9615	2.5000			(27a)	
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000	(28a)	
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000	(29a)	
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800	(30)	
Total net area of external elements Aum, m2			638.0800					(31)	
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	137.9251				(33)	
Internal Wall 1			331.8500					9.0000	2986.6500 (32c)
Internal Floor 1			119.5000					18.0000	2151.0000 (32d)
Internal Ceiling 1			119.5000					9.0000	1075.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 61075.0300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 204.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0190	0.8269
E3 Sill	29.3000	0.0160	0.4688
E4 Jamb	92.6000	0.0180	1.6668
E5 Ground floor (normal)	59.2200	0.0540	3.1979
E6 Intermediate floor within a dwelling	51.5000	0.0080	0.4120
E11 Eaves (insulation at rafter level)	41.0000	0.0480	1.9680
E13 Gable (insulation at rafter level)	18.2200	0.0560	1.0203
E16 Corner (normal)	24.5500	0.0400	0.9820
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0680	-0.4590

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0837 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 148.0087 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.0075	61.3188	60.6301	57.1868	56.4981	53.0548	53.0548	52.3661	54.4321	56.4981	57.8755	59.2528	(38)
Heat transfer coeff	210.0162	209.3275	208.6389	205.1955	204.5069	201.0635	201.0635	200.3749	202.4409	204.5069	205.8842	207.2615	(39)
Average = Sum(39)m / 12 =													205.0234

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7044	0.7021	0.6998	0.6883	0.6859	0.6744	0.6744	0.6721	0.6790	0.6859	0.6906	0.6952	(40)
HLP (average)													0.6877
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1295 (42)
Hot water usage for mixer showers													76.3977 (42a)
Hot water usage for baths													32.9912 (42b)
Hot water usage for other uses													46.6793 (42c)
Average daily hot water use (litres/day)													143.8346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682	(44)
Energy conte	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651	(45)
Energy content (annual)													2389.0621
Distribution loss (46)m = 0.15 x (45)m													358.3593

Water storage loss: 37.1725 32.7088 34.3657 29.3385 27.8361 24.4293 23.6514 24.9670 25.6544 29.3862 32.1947 36.6548 (46)

Store volume 150.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.9100 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.0314 (55)
 Total storage loss 31.9734 28.8792 31.9734 30.9420 31.9734 30.9420 31.9734 31.9734 30.9420 31.9734 30.9420 31.9734 (56)

If cylinder contains dedicated solar storage													31.9734 (57)
Primary loss													23.2624 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													303.0523 (62)
WWHRS													0.0000 (63a)
PV diverter													-0.0000 (63b)
Solar input													0.0000 (63c)
FGHRS													0.0000 (63d)

Output from w/h 303.0523 267.9488 284.3403 249.0440 240.8101 216.3161 212.9117 221.6826 224.4831 251.1438 268.0854 299.6009 (64)
 Total per year (kWh/year) = Sum(64)m = 3039.4191 (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 126.5876 112.4168 120.3659 107.7969 105.8921 96.9148 96.6159 99.5322 99.6304 109.3280 114.1281 125.4400 (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	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.9736	58.5972	47.6544	36.0775	26.9683	22.7678	24.6014	31.9779	42.9206	54.4976	63.6067	67.8072 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	681.7263	688.8005	670.9738	633.0228	585.1165	540.0913	510.0118	502.9376	520.7643	558.7153	606.6216	651.6467 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066 (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)												
	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Water heating gains (Table 5)												
	170.1447	167.2868	161.7821	149.7179	142.3281	134.6039	129.8600	133.7799	138.3755	146.9463	158.5113	168.6022 (72)
Total internal gains												
	1037.3414	1034.1813	999.9072	938.3150	873.9098	816.9599	783.9700	788.1921	821.5573	879.6560	948.2364	1007.5530 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast	12.6600	11.2829	0.5700	0.8000	0.7700	45.1392 (75)						
Southeast	9.0900	36.7938	0.5700	0.8000	0.7700	105.6908 (77)						
Southwest	11.2500	36.7938	0.5700	0.8000	0.7700	130.8054 (79)						
Northwest	38.5400	11.2829	0.5700	0.8000	0.7700	137.4144 (81)						
Southeast	2.6000	37.7778	0.5700	0.8000	1.0000	40.3104 (82)						

Solar gains	459.3601	850.4178	1340.5433	1951.8289	2447.4783	2543.5833	2405.0082	2018.5730	1549.9942	987.9494	562.6692	385.0064 (83)
Total gains	1496.7016	1884.5992	2340.4504	2890.1439	3321.3880	3360.5433	3188.9783	2806.7651	2371.5515	1867.6053	1510.9056	1392.5594 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil, m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	80.7808	81.0466	81.3141	82.6786	82.9570	84.3777	84.3777	84.6677	83.8037	82.9570	82.4021	81.8545
alpha	6.3854	6.4031	6.4209	6.5119	6.5305	6.6252	6.6252	6.6445	6.5869	6.5305	6.4935	6.4570
util living area	0.9975	0.9892	0.9488	0.7929	0.5661	0.3825	0.2774	0.3283	0.5815	0.9165	0.9925	0.9984 (86)
Living	20.2514	20.4279	20.6717	20.8856	20.9449	20.9526	20.9530	20.9531	20.9466	20.8075	20.4773	20.2235
Non living	19.4381	19.6644	19.9696	20.2252	20.2861	20.3030	20.3033	20.3055	20.2946	20.1466	19.7369	19.4091
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	20.6171	20.4279	20.6717	20.8856	20.9449	20.9526	20.9530	20.9531	20.9466	20.8075	20.4773	20.3321 (87)
Th 2	20.3369	20.3390	20.3410	20.3512	20.3533	20.3635	20.3635	20.3656	20.3594	20.3533	20.3492	20.3451 (88)
util rest of house	0.9969	0.9866	0.9377	0.7630	0.5287	0.3446	0.2373	0.2831	0.5303	0.8939	0.9903	0.9980 (89)
MIT 2	19.9786	19.6644	19.9696	20.2252	20.2861	20.3030	20.3033	20.3055	20.2946	20.1466	19.7369	19.5778 (90)
Living area fraction									FLA = Living area / (4) =			0.3514 (91)
MIT	20.2029	19.9327	20.2163	20.4573	20.5176	20.5313	20.5316	20.5330	20.5237	20.3789	19.9970	19.8428 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2029	19.9327	20.2163	20.4573	20.5176	20.5313	20.5316	20.5330	20.5237	20.3789	19.9970	19.8428 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9967	0.9846	0.9354	0.7680	0.5383	0.3546	0.2479	0.2950	0.5436	0.8949	0.9888	0.9976 (94)
Useful gains	1491.7787	1855.5772	2189.2278	2219.7704	1787.8321	1191.7589	790.4452	827.9821	1289.0737	1671.3851	1493.9229	1389.1631 (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	3339.8726	3146.7578	2861.7552	2371.5008	1803.2544	1192.5632	790.5029	828.1576	1300.4135	1999.8420	2655.2925	3242.1573 (97)
Space heating kWh	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277 (98a)
Space heating requirement - total per year (kWh/year)												5322.9213
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	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5322.9213
Space heating per m ²										(98c) / (4) =		17.8538 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												407.2725 (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	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277 (98)
Space heating efficiency (main heating system 1)	407.2725	407.2725	407.2725	407.2725	407.2725	0.0000	0.0000	0.0000	0.0000	407.2725	407.2725	407.2725 (210)
Space heating fuel (main heating system)	337.6074	213.0449	122.8564	26.8238	2.8173	0.0000	0.0000	0.0000	0.0000	60.0021	205.3137	338.5026 (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)												

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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	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009	299.6009	(64)
Efficiency of water heater (217)m	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	(216)
Fuel for water heating, kWh/month	158.6012	140.2299	148.8084	130.3361	126.0270	113.2081	111.4265	116.0167	117.4823	131.4351	140.3014	156.7949	156.7949	(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	0.0000	(221)
Pumps and Fa	97.8414	88.3729	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	(231)
Lighting	57.7463	46.3263	41.7117	30.5597	23.6052	19.2857	21.5335	27.9900	36.3563	47.7014	53.8786	59.3513	59.3513	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-143.8039	-228.9006	-362.2639	-434.7202	-489.3936	-464.6506	-459.4817	-424.2867	-359.9188	-276.3710	-166.9460	-121.1432	-121.1432	(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	-6.4556	-21.8393	-64.7748	-137.5959	-217.6548	-230.4905	-226.4728	-175.0352	-109.4705	-44.1666	-11.2834	-4.5983	-4.5983	(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													1306.9681	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													191.0782	(217)
Water heating fuel used													1590.6676	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140) mechanical ventilation fans (SFP = 1.4140)													1152.0032	(230a)
Total electricity for the above, kWh/year													1152.0032	(231)
Electricity for lighting (calculated in Appendix L)													466.0460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-5181.7182	(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													-666.0332	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1306.9681	16.4900	215.5190	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1590.6676	16.4900	262.3011	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	1152.0032	16.4900	189.9653	(249)
Energy for lighting	466.0460	16.4900	76.8510	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3931.8802	16.4900	-648.3670	
PV Unit electricity exported	-1249.8380	5.5900	-69.8659	
Total			-718.2330	(252)
Total energy cost			26.4035	(255)

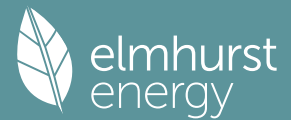
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.0277	(257)
SAP value		99.5510	
SAP rating (Section 12)		100	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1306.9681	0.1580	206.4605	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1590.6676	0.1410	224.2284	(264)
Space and water heating			430.6888	(265)
Pumps, fans and electric keep-hot	1152.0032	0.1387	159.7971	(267)
Energy for lighting	466.0460	0.1443	67.2648	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3931.8802	0.1330	-522.9878	
PV Unit electricity exported	-1249.8380	0.1187	-148.3753	
Total			-671.3631	(269)
Total CO2, kg/year			-13.6124	(272)
CO2 emissions per m2			-0.0500	(273)
EI value			100.0532	
EI rating			100	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 667.7970 (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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure Test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.5000 (17)
Infiltration rate		0.1250 (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) =	0.1250 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.5000	6.1000	6.0000	5.2000	5.2000	4.7000	4.6000	4.6000	5.0000	5.9000	6.0000	6.4000 (22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000 (22a)
Adj infilt rate	0.2031	0.1906	0.1875	0.1625	0.1625	0.1469	0.1437	0.1437	0.1562	0.1844	0.1875	0.2000 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												75.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3251	0.3126	0.3095	0.2845	0.2845	0.2689	0.2657	0.2657	0.2782	0.3064	0.3095	0.3220 (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
Windows (Uw = 1.00)			71.5400	0.9615	68.7885		(27)
South East			2.6000	0.9615	2.5000		(27a)
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000 (28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000 (29a)
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800 (30)
Total net area of external elements Aum(A, m ²)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.9251		(33)
Internal Wall 1			331.8500			9.0000	2986.6500 (32c)
Internal Floor 1			119.5000			18.0000	2151.0000 (32d)
Internal Ceiling 1			119.5000			9.0000	1075.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 61075.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K = 204.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0190	0.8269
E3 Sill	29.3000	0.0160	0.4688
E4 Jamb	92.6000	0.0180	1.6668
E5 Ground floor (normal)	59.2200	0.0540	3.1979
E6 Intermediate floor within a dwelling	51.5000	0.0080	0.4120
E11 Eaves (insulation at rafter level)	41.0000	0.0480	1.9680
E13 Gable (insulation at rafter level)	18.2200	0.0560	1.0203
E16 Corner (normal)	24.5500	0.0400	0.9820
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0680	-0.4590
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.0837 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 148.0087 (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	71.6488	68.8941	68.2054	62.6961	62.6961	59.2528	58.5641	58.5641	61.3188	67.5168	68.2054	70.9601 (38)
Average = Sum(39)m / 12 =	219.6575	216.9029	216.2142	210.7049	210.7049	207.2615	206.5729	206.5729	209.3275	215.5255	216.2142	218.9689 (39)
HLP	0.7368	0.7275	0.7252	0.7067	0.7067	0.6952	0.6929	0.6929	0.7021	0.7229	0.7252	0.7344 (40)
HLP (average)												0.7140

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.1295 (42)
Hot water usage for mixer showers	76.6915	75.5390	73.8595	70.6462	68.2749	65.6303	64.1272	65.7939	67.6210	70.4604	73.7428	76.3977 (42a)
Hot water usage for baths	33.1031	32.6115	31.9191	30.6426	29.6868	28.6269	28.0545	28.7419	29.4905	30.6246	31.9273	32.9912 (42b)
Hot water usage for other uses	46.6793	44.9819	43.2845	41.5870	39.8896	38.1922	38.1922	39.8896	41.5870	43.2845	44.9819	46.6793 (42c)
Average daily hot water use (litres/day)												143.8346 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682 (44)
Energy content (annual)	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2389.0621
Water storage loss:	37.1725	32.7088	34.3657	29.3385	27.8361	24.4293	23.6514	24.9670	25.6544	29.3862	32.1947	36.6548 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0314 (55)
Total storage loss												31.9734 (56)
If cylinder contains dedicated solar storage	31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (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	126.5876	112.4168	120.3659	107.7969	105.8921	96.9148	96.6159	99.5322	99.6304	109.3280	114.1281	125.4400 (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	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.9736	58.5972	47.6544	36.0775	26.9683	22.7678	24.6014	31.9779	42.9206	54.4976	63.6067	67.8072 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	681.7263	688.8005	670.9738	633.0228	585.1165	540.0913	510.0118	502.9376	520.7643	558.7153	606.6216	651.6467 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066 (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)	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Water heating gains (Table 5)	170.1447	167.2868	161.7821	149.7179	142.3281	134.6039	129.8600	133.7799	138.3755	146.9463	158.5113	168.6022 (72)
Total internal gains	1037.3414	1034.1813	999.9072	938.3150	873.9098	816.9599	783.9700	788.1921	821.5573	879.6560	948.2364	1007.5530 (73)
6. Solar gains												
[Jan]	Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	12.6600		15.0382		0.5700		0.8000		0.7700		60.1626 (75)	
Southeast	9.0900		46.2729		0.5700		0.8000		0.7700		132.9195 (77)	
Southwest	11.2500		46.2729		0.5700		0.8000		0.7700		164.5044 (79)	
Northwest	38.5400		15.0382		0.5700		0.8000		0.7700		183.1489 (81)	
Southeast	2.6000		49.1564		0.5700		0.8000		1.0000		52.4518 (82)	
Solar gains	593.1872	943.5864	1503.3396	2231.2834	2710.0459	2938.6502	2543.4885	2288.9374	1777.3171	1118.9347	704.6726	491.5926 (83)
Total gains	1630.5287	1977.7677	2503.2468	3169.5983	3583.9556	3755.6101	3327.4586	3077.1295	2598.8744	1998.5907	1652.9090	1499.1455 (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	77.2352	78.2161	78.4652	80.5168	80.5168	81.8545	82.1274	82.1274	81.0466	78.7159	78.4652	77.4781
alpha	6.1490	6.2144	6.2310	6.3678	6.3678	6.4570	6.4752	6.4752	6.4031	6.2477	6.2310	6.1652
util living area	0.9930	0.9798	0.9207	0.7505	0.5469	0.3803	0.3227	0.3355	0.5272	0.8633	0.9773	0.9950 (86)
Living	20.3792	20.5178	20.7303	20.8993	20.9441	20.9513	20.9519	20.9518	20.9475	20.8537	20.6116	20.3612
Non living	19.5777	19.7591	20.0196	20.2229	20.2665	20.2830	20.2855	20.2855	20.2741	20.1673	19.8803	19.5567
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	20.6824	20.5178	20.7303	20.8993	20.9441	20.9513	20.9519	20.9518	20.9475	20.8537	20.6116	20.4506 (87)
Th 2	20.3085	20.3166	20.3186	20.3349	20.3349	20.3451	20.3471	20.3471	20.3390	20.3206	20.3186	20.3105 (88)

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util rest of house	0.9911	0.9747	0.9042	0.7185	0.5099	0.3444	0.2822	0.2918	0.4761	0.8287	0.9701	0.9935 (89)
MIT 2	20.0171	19.7591	20.0196	20.2229	20.2665	20.2830	20.2855	20.2855	20.2741	20.1673	19.8803	19.6926 (90)
Living area fraction									fLA = Living area / (4) =			0.3514 (91)
MIT	20.2509	20.0257	20.2693	20.4606	20.5046	20.5178	20.5196	20.5196	20.5107	20.4085	20.1372	19.9589 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2509	20.0257	20.2693	20.4606	20.5046	20.5178	20.5196	20.5196	20.5107	20.4085	20.1372	19.9589 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9721	0.9029	0.7248	0.5194	0.3539	0.2929	0.3033	0.4895	0.8335	0.9678	0.9926	(94)
Useful gains	1615.7107	1922.6103	2260.1065	2297.1948	1861.6136	1329.1058	974.7038	933.3402	1272.1699	1665.8734	1599.7048	1488.0753	(95)
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000	(96)
Heat loss rate W	3108.3537	2977.1456	2782.5322	2414.7938	1876.2431	1330.1615	974.9472	933.6282	1279.1461	1876.9011	2408.0290	2968.9801	(97)
Space heating kWh	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931	(98a)
Space heating requirement - total per year (kWh/year)												4144.2056	
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	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4144.2056	
Space heating per m2										(98c) / (4) =		13.9002	(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 %)													407.8380 (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	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931	(98)
Space heating efficiency (main heating system 1)	407.8380	407.8380	407.8380	407.8380	407.8380	0.0000	0.0000	0.0000	0.0000	407.8380	407.8380	407.8380	(210)
Space heating fuel (main heating system)	272.2960	173.7572	95.3037	20.7610	2.6688	0.0000	0.0000	0.0000	0.0000	38.4968	142.7021	270.1546	(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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009	(64)
Efficiency of water heater (217)m	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	(216)
Fuel for water heating, kWh/month	157.7310	139.4605	147.9919	129.6210	125.3355	112.5870	110.8151	115.3801	116.8377	130.7139	139.5316	155.9346	(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	97.8414	88.3729	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	94.6852	97.8414	94.6852	97.8414	(231)
Lighting	57.7463	46.3263	41.7117	30.5597	23.6052	19.2857	21.5335	27.9900	36.3563	47.7014	53.8786	59.3513	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-182.7263	-249.4370	-392.4876	-471.3034	-515.6746	-499.4188	-470.5603	-454.5421	-393.0856	-303.6509	-204.1968	-152.8099	(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	-11.4354	-27.7692	-81.7590	-173.8850	-256.0613	-292.7968	-244.7802	-215.2951	-138.7815	-57.2185	-18.8979	-8.0219	(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													1016.1401 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													192.1324
Water heating fuel used													1581.9398 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140) mechanical ventilation fans (SFP = 1.4140)													1152.0032 (230a)
Total electricity for the above, kWh/year													1152.0032 (231)
Electricity for lighting (calculated in Appendix L)													466.0460 (232)

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

PV generation													-5816.5951 (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													-1600.4659 (238)

10a. Fuel costs - using BEDF prices (538)

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	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1016.1401	25.1600	255.6609 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1581.9398	25.1600	398.0161 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	1152.0032	25.1600	289.8440 (249)
Energy for lighting	466.0460	25.1600	117.2572 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4289.8933	25.1600	-1079.3372
PV Unit electricity exported	-1526.7018	5.8100	-88.7014
Total			-1168.0385 (252)
Total energy cost			-107.2604 (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	1016.1401	0.1584	160.9067 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1581.9398	0.1410	222.9981 (264)
Space and water heating			383.9048 (265)
Pumps, fans and electric keep-hot	1152.0032	0.1387	159.7971 (267)
Energy for lighting	466.0460	0.1443	67.2648 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4289.8933	0.1336	-573.2762
PV Unit electricity exported	-1526.7018	0.1199	-182.9765
Total			-756.2527 (269)
Total CO2, kg/year			-145.2860 (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	1016.1401	1.5861	1611.7393 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1581.9398	1.5212	2406.5110 (278)
Space and water heating			4018.2503 (279)
Pumps, fans and electric keep-hot	1152.0032	1.5128	1742.7505 (281)
Energy for lighting	466.0460	1.5338	714.8369 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4289.8933	1.4938	-6408.3418
PV Unit electricity exported	-1526.7018	0.4397	-671.3634
Total			-7079.7052 (283)
Total Primary energy kWh/year			-603.8675 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 100
Current environmental impact rating: A 100

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 + 0.7 -£ 68 -42 kg (29.2%)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
Total Savings	£0	0.00 kg/m ²	

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1061	£1061	£0
Space heating	£546	£546	£0
Water heating	£398	£398	£0
Lighting	£117	£117	£0
Generated (PV)	-£1168	-£1168	£0
Total cost of fuels	-£107	-£107	£0
Total cost of uses	-£107	-£107	£0
Delivered energy	-5 kWh/m ²	-5 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	-0 kg/m ²	-0 kg/m ²	0 kg/m ²
Primary energy	-2 kWh/m ²	-2 kWh/m ²	0 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 667.7970 (5)

2. Ventilation rate

	Value	Reference
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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Value	Reference
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		2.5000 (17)
Infiltration rate		0.1250 (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) =	0.1250 (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	0.1594	0.1562	0.1531	0.1375	0.1344	0.1187	0.1187	0.1156	0.1250	0.1344	0.1406	0.1469 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												75.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2814	0.2782	0.2751	0.2595	0.2564	0.2407	0.2407	0.2376	0.2470	0.2564	0.2626	0.2689 (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
Windows (Uw = 1.00)			71.5400	0.9615	68.7885		(27)
South East			2.6000	0.9615	2.5000		(27a)
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000 (28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000 (29a)
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800 (30)
Total net area of external elements Aum(A, m ²)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.9251		(33)
Internal Wall 1			331.8500			9.0000	2986.6500 (32c)
Internal Floor 1			119.5000			18.0000	2151.0000 (32d)
Internal Ceiling 1			119.5000			9.0000	1075.5000 (32e)

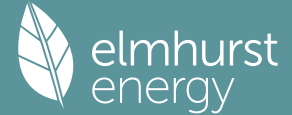
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	61075.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		204.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0190	0.8269
E3 Sill	29.3000	0.0160	0.4688
E4 Jamb	92.6000	0.0180	1.6668
E5 Ground floor (normal)	59.2200	0.0540	3.1979
E6 Intermediate floor within a dwelling	51.5000	0.0080	0.4120
E11 Eaves (insulation at rafter level)	41.0000	0.0480	1.9680
E13 Gable (insulation at rafter level)	18.2200	0.0560	1.0203
E16 Corner (normal)	24.5500	0.0400	0.9820
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0680	-0.4590
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.0837 (36)
Point Thermal bridges			0.0000
Total fabric heat loss	(33) + (36) + (36a) =		148.0087 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	62.0075	61.3188	60.6301	57.1868	56.4981	53.0548	53.0548	52.3661	54.4321	56.4981	57.8755	59.2528 (38)
Heat transfer coeff	210.0162	209.3275	208.6389	205.1955	204.5069	201.0635	201.0635	200.3749	202.4409	204.5069	205.8842	207.2615 (39)
Average = Sum(39)m / 12 =												205.0234
HLP	0.7044	0.7021	0.6998	0.6883	0.6859	0.6744	0.6744	0.6721	0.6790	0.6859	0.6906	0.6952 (40)
HLP (average)												0.6877
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Hot water usage for mixer showers												3.1295 (42)
76.6915	75.5390	73.8595	70.6462	68.2749	65.6303	64.1272	65.7939	67.6210	70.4604	73.7428	76.3977 (42a)	
Hot water usage for baths												
33.1031	32.6115	31.9191	30.6426	29.6868	28.6269	28.0545	28.7419	29.4905	30.6246	31.9273	32.9912 (42b)	
Hot water usage for other uses												
46.6793	44.9819	43.2845	41.5870	39.8896	38.1922	38.1922	39.8896	41.5870	43.2845	44.9819	46.6793 (42c)	
Average daily hot water use (litres/day)												143.8346 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682 (44)	
Energy content	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651 (45)
Energy content (annual)												Total = Sum(45)m = 2389.0621
Distribution loss (46)m = 0.15 x (45)m												
37.1725	32.7088	34.3657	29.3385	27.8361	24.4293	23.6514	24.9670	25.6544	29.3862	32.1947	36.6548 (46)	
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0314 (55)
Total storage loss												
31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734 (56)	
If cylinder contains dedicated solar storage												
31.9734	28.8792	31.9734	30.9420	31.9734	30.9420	31.9734	31.9734	30.9420	31.9734	30.9420	31.9734 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854 (64)	
Total per year (kWh/year) = Sum(64)m =												3039.4191 (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	126.5876	112.4168	120.3659	107.7969	105.8921	96.9148	96.6159	99.5322	99.6304	109.3280	114.1281	125.4400 (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
187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.9736	58.5972	47.6544	36.0775	26.9683	22.7678	24.6014	31.9779	42.9206	54.4976	63.6067	67.8072 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
681.7263	688.8005	670.9738	633.0228	585.1165	540.0913	510.0118	502.9376	520.7643	558.7153	606.6216	651.6467 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066 (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)												
-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)	
Water heating gains (Table 5)												
170.1447	167.2868	161.7821	149.7179	142.3281	134.6039	129.8600	133.7799	138.3755	146.9463	158.5113	168.6022 (72)	
Total internal gains	1037.3414	1034.1813	999.9072	938.3150	873.9098	816.9599	783.9700	788.1921	821.5573	879.6560	948.2364	1007.5530 (73)

6. Solar gains

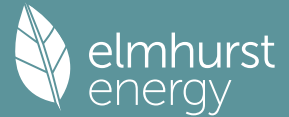
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	12.6600	11.2829	0.5700	0.8000	0.7700	45.1392 (75)						
Southeast	9.0900	36.7938	0.5700	0.8000	0.7700	105.6908 (77)						
Southwest	11.2500	36.7938	0.5700	0.8000	0.7700	130.8054 (79)						
Northwest	38.5400	11.2829	0.5700	0.8000	0.7700	137.4144 (81)						
Southeast	2.6000	37.7778	0.5700	0.8000	1.0000	40.3104 (82)						

Solar gains	459.3601	850.4178	1340.5433	1951.8289	2447.4783	2543.5833	2405.0082	2018.5730	1549.9942	987.9494	562.6692	385.0064 (83)
Total gains	1496.7016	1884.5992	2340.4504	2890.1439	3321.3880	3360.5433	3188.9783	2806.7651	2371.5515	1867.6053	1510.9056	1392.5594 (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)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
80.7808	81.0466	81.3141	82.6786	82.9570	84.3777	84.3777	84.6677	83.8037	82.9570	82.4021	81.8545	
alpha	6.3854	6.4031	6.4209	6.5119	6.5305	6.6252	6.6252	6.6445	6.5869	6.5305	6.4935	6.4570
util living area	0.9975	0.9892	0.9488	0.7929	0.5661	0.3825	0.2774	0.3283	0.5815	0.9165	0.9925	0.9984 (86)
Living	20.2514	20.4279	20.6717	20.8856	20.9449	20.9526	20.9530	20.9531	20.9466	20.8075	20.4773	20.2235
Non living	19.4381	19.6644	19.9696	20.2252	20.2861	20.3030	20.3033	20.3055	20.2946	20.1466	19.7369	19.4091
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	20.6171	20.4279	20.6717	20.8856	20.9449	20.9526	20.9530	20.9531	20.9466	20.8075	20.4773	20.3321 (87)
Th 2	20.3369	20.3390	20.3410	20.3512	20.3533	20.3635	20.3635	20.3656	20.3594	20.3533	20.3492	20.3451 (88)
util rest of house												

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MIT 2	0.9969	0.9866	0.9377	0.7630	0.5287	0.3446	0.2373	0.2831	0.5303	0.8939	0.9903	0.9980 (89)
Living area fraction	19.9786	19.6644	19.9696	20.2252	20.2861	20.3030	20.3033	20.3055	20.2946	20.1466	19.7369	19.5778 (90)
MIT	20.2029	19.9327	20.2163	20.4573	20.5176	20.5313	20.5316	20.5330	20.5237	20.3789	19.9970	0.3514 (91)
Temperature adjustment												19.8428 (92)
adjusted MIT	20.2029	19.9327	20.2163	20.4573	20.5176	20.5313	20.5316	20.5330	20.5237	20.3789	19.9970	19.8428 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9846	0.9354	0.7680	0.5383	0.3546	0.2479	0.2950	0.5436	0.8949	0.9888	0.9976	(94)
Useful gains	1491.7787	1855.5772	2189.2278	2219.7704	1787.8321	1191.7589	790.4452	827.9821	1289.0737	1671.3851	1493.9229	1389.1631	(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	3339.8726	3146.7578	2861.7552	2371.5008	1803.2544	1192.5632	790.5029	828.1576	1300.4135	1999.8420	2655.2925	3242.1573	(97)
Space heating kWh	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277	(98a)
Space heating requirement - total per year (kWh/year)												5322.9213	
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	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5322.9213	
Space heating per m2												(98c) / (4) =	17.8538 (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 %)													407.2725 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1374.9819	867.6734	500.3603	109.2458	11.4741	0.0000	0.0000	0.0000	0.0000	244.3719	836.1861	1378.6277	(98)
Space heating efficiency (main heating system 1)	407.2725	407.2725	407.2725	407.2725	407.2725	0.0000	0.0000	0.0000	0.0000	407.2725	407.2725	407.2725	(210)
Space heating fuel (main heating system)	337.6074	213.0449	122.8564	26.8238	2.8173	0.0000	0.0000	0.0000	0.0000	60.0021	205.3137	338.5026	(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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009	(64)
Efficiency of water heater	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	191.0782	(216)
Fuel for water heating, kWh/month	158.6012	140.2299	148.8084	130.3361	126.0270	113.2081	111.4265	116.0167	117.4823	131.4351	140.3014	156.7949	(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	97.8414	88.3729	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	94.6852	97.8414	94.6852	97.8414	(231)
Lighting	57.7463	46.3263	41.7117	30.5597	23.6052	19.2857	21.5335	27.9900	36.3563	47.7014	53.8786	59.3513	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-143.8039	-228.9006	-362.2639	-434.7202	-489.3936	-464.6506	-459.4817	-424.2867	-359.9188	-276.3710	-166.9460	-121.1432	(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)	-6.4556	-21.8393	-64.7748	-137.5959	-217.6548	-230.4905	-226.4728	-175.0352	-109.4705	-44.1666	-11.2834	-4.5983	(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													1306.9681 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													191.0782
Water heating fuel used													1590.6676 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140)													
mechanical ventilation fans (SFP = 1.4140)													1152.0032 (230a)
Total electricity for the above, kWh/year													1152.0032 (231)
Electricity for lighting (calculated in Appendix L)													466.0460 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-5181.7182 (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													-666.0332 (238)

10a. Fuel costs - using Table 12 prices

Fuel	Fuel price	Fuel cost
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	kWh/year	p/kWh	£/year
Space heating - main system 1	1306.9681	16.4900	215.5190 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1590.6676	16.4900	262.3011 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	1152.0032	16.4900	189.9653 (249)
Energy for lighting	466.0460	16.4900	76.8510 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3931.8802	16.4900	-648.3670
PV Unit electricity exported	-1249.8380	5.5900	-69.8659
Total			-718.2330 (252)
Total energy cost			26.4035 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.0277 (257)
SAP value		99.5510
SAP rating (Section 12)		100 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1306.9681	0.1580	206.4605 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1590.6676	0.1410	224.2284 (264)
Space and water heating			430.6888 (265)
Pumps, fans and electric keep-hot	1152.0032	0.1387	159.7971 (267)
Energy for lighting	466.0460	0.1443	67.2648 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3931.8802	0.1330	-522.9878
PV Unit electricity exported	-1249.8380	0.1187	-148.3753
Total			-671.3631 (269)
Total CO2, kg/year			-13.6124 (272)
CO2 emissions per m2			-0.0500 (273)
EI value			100.0532
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

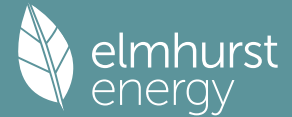
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	178.6400 (1b)	x 2.3000 (2b)	= 410.8720 (1b) - (3b)
First floor	119.5000 (1c)	x 2.1500 (2c)	= 256.9250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	298.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	667.7970 (5)

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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1250 (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) = 0.1250 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.5000	6.1000	6.0000	5.2000	5.2000	4.7000	4.6000	4.6000	5.0000	5.9000	6.0000	6.4000 (22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000 (22a)
Adj infilt rate	0.2031	0.1906	0.1875	0.1625	0.1625	0.1469	0.1437	0.1437	0.1562	0.1844	0.1875	0.2000 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												

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If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
 If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.6000 (23c)
 Effective ac 0.3251 0.3126 0.3095 0.2845 0.2845 0.2689 0.2657 0.2657 0.2782 0.3064 0.3095 0.3220 (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
Windows (Uw = 1.00)			71.5400	0.9615	68.7885		(27)
South East			2.6000	0.9615	2.5000		(27a)
Ground Floor			178.6400	0.1200	21.4368	110.0000	19650.4000 (28a)
Cavity Wall	246.9200	71.5400	175.3800	0.1500	26.3070	190.0000	33322.2000 (29a)
Warm Roof	212.5200	2.6000	209.9200	0.0900	18.8928	9.0000	1889.2800 (30)
Total net area of external elements Aum(A, m2)			638.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	137.9251		(33)
Internal Wall 1			331.8500			9.0000	2986.6500 (32c)
Internal Floor 1			119.5000			18.0000	2151.0000 (32d)
Internal Ceiling 1			119.5000			9.0000	1075.5000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 61075.0300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 204.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	43.5200	0.0190	0.8269
E3 Sill	29.3000	0.0160	0.4688
E4 Jamb	92.6000	0.0180	1.6668
E5 Ground floor (normal)	59.2200	0.0540	3.1979
E6 Intermediate floor within a dwelling	51.5000	0.0080	0.4120
E11 Eaves (insulation at rafter level)	41.0000	0.0480	1.9680
E13 Gable (insulation at rafter level)	18.2200	0.0560	1.0203
E16 Corner (normal)	24.5500	0.0400	0.9820
E17 Corner (inverted - internal area greater than external area)	6.7500	-0.0680	-0.4590

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0837 (36)

Total Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 148.0087 (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	71.6488	68.8941	68.2054	62.6961	62.6961	59.2528	58.5641	58.5641	61.3188	67.5168	68.2054	70.9601 (38)
Average = Sum(39)m / 12 =	219.6575	216.9029	216.2142	210.7049	210.7049	207.2615	206.5729	206.5729	209.3275	215.5255	216.2142	218.8856 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7368	0.7275	0.7252	0.7067	0.7067	0.6952	0.6929	0.6929	0.7021	0.7229	0.7252	0.7344 (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	3.1295 (42)											
Hot water usage for mixer showers	76.6915	75.5390	73.8595	70.6462	68.2749	65.6303	64.1272	65.7939	67.6210	70.4604	73.7428	76.3977 (42a)
Hot water usage for baths	33.1031	32.6115	31.9191	30.6426	29.6868	28.6269	28.0545	28.7419	29.4905	30.6246	31.9273	32.9912 (42b)
Hot water usage for other uses	46.6793	44.9819	43.2845	41.5870	39.8896	38.1922	38.1922	39.8896	41.5870	43.2845	44.9819	46.6793 (42c)
Average daily hot water use (litres/day)												143.8346 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	156.4739	153.1324	149.0632	142.8759	137.8513	132.4495	130.3738	134.4255	138.6985	144.3694	150.6520	156.0682 (44)
Energy content (annual)	247.8165	218.0584	229.1045	195.5900	185.5743	162.8621	157.6759	166.4468	171.0291	195.9080	214.6314	244.3651 (45)
Distribution loss (46)m = 0.15 x (45)m	37.1725	32.7088	34.3657	29.3385	27.8361	24.4293	23.6514	24.9670	25.6544	29.3862	32.1947	36.6548 (46)

Water storage loss: 150.0000 (47)
 Store volume 1.9100 (48)

a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.0314 (55)

Total storage loss 31.9734 28.8792 31.9734 30.9420 31.9734 30.9420 31.9734 31.9734 30.9420 31.9734 30.9420 31.9734 31.9734 (56)

If cylinder contains dedicated solar storage 31.9734 28.8792 31.9734 30.9420 31.9734 30.9420 31.9734 31.9734 30.9420 31.9734 30.9420 31.9734 31.9734 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 303.0523 267.9488 284.3403 249.0440 240.8101 216.3161 212.9117 221.6826 224.4831 251.1438 268.0854 299.6009 (62)

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

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

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

Output from w/h 303.0523 267.9488 284.3403 249.0440 240.8101 216.3161 212.9117 221.6826 224.4831 251.1438 268.0854 299.6009 (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 126.5876 112.4168 120.3659 107.7969 105.8921 96.9148 96.6159 99.5322 99.6304 109.3280 114.1281 125.4400 (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	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707	187.7707 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.9736	58.5972	47.6544	36.0775	26.9683	22.7678	24.6014	31.9779	42.9206	54.4976	63.6067	67.8072 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	681.7263	688.8005	670.9738	633.0228	585.1165	540.0913	510.0118	502.9376	520.7643	558.7153	606.6216	651.6467 (68)
Pumps, fans	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066	56.9066 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805	-125.1805 (71)
Total internal gains	170.1447	167.2868	161.7821	149.7179	142.3281	134.6039	129.8600	133.7799	138.3755	146.9463	158.5113	168.6022 (72)
	1037.3414	1034.1813	999.9072	938.3150	873.9098	816.9599	783.9700	788.1921	821.5573	879.6560	948.2364	1007.5530 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	12.6600	15.0382	0.5700	0.8000	0.7700	60.1626 (75)						
Southeast	9.0900	46.2729	0.5700	0.8000	0.7700	132.9195 (77)						
Southwest	11.2500	46.2729	0.5700	0.8000	0.7700	164.5044 (79)						
Northwest	38.5400	15.0382	0.5700	0.8000	0.7700	183.1489 (81)						
Southeast	2.6000	49.1564	0.5700	0.8000	1.0000	52.4518 (82)						
Solar gains	593.1872	943.5864	1503.3396	2231.2834	2710.0459	2938.6502	2543.4885	2288.9374	1777.3171	1118.9347	704.6726	491.5926 (83)
Total gains	1630.5287	1977.7677	2503.2468	3169.5983	3583.9556	3755.6101	3327.4586	3077.1295	2598.8744	1998.5907	1652.9090	1499.1455 (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	77.2352	78.2161	78.4652	80.5168	80.5168	81.8545	82.1274	82.1274	81.0466	78.7159	78.4652	77.4781
util living area	6.1490	6.2144	6.2310	6.3678	6.3678	6.4570	6.4752	6.4752	6.4031	6.2477	6.2310	6.1652
util living area	0.9930	0.9798	0.9207	0.7505	0.5469	0.3803	0.3227	0.3355	0.5272	0.8633	0.9773	0.9950 (86)
Living	20.3792	20.5178	20.7303	20.8993	20.9441	20.9513	20.9519	20.9518	20.9475	20.8537	20.6116	20.3612
Non living	19.5777	19.7591	20.0196	20.2229	20.2665	20.2830	20.2855	20.2855	20.2741	20.1673	19.8803	19.5567
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	20.6824	20.5178	20.7303	20.8993	20.9441	20.9513	20.9519	20.9518	20.9475	20.8537	20.6116	20.4506 (87)
Th 2	20.3085	20.3166	20.3186	20.3349	20.3349	20.3451	20.3471	20.3471	20.3390	20.3206	20.3186	20.3105 (88)
util rest of house	0.9911	0.9747	0.9042	0.7185	0.5099	0.3444	0.2822	0.2918	0.4761	0.8287	0.9701	0.9935 (89)
MIT 2	20.0171	19.7591	20.0196	20.2229	20.2665	20.2830	20.2855	20.2855	20.2741	20.1673	19.8803	19.6926 (90)
Living area fraction										FLA = Living area / (4) =		
MIT	20.2509	20.0257	20.2693	20.4606	20.5046	20.5178	20.5196	20.5196	20.5107	20.4085	20.1372	19.9589 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2509	20.0257	20.2693	20.4606	20.5046	20.5178	20.5196	20.5196	20.5107	20.4085	20.1372	19.9589 (93)

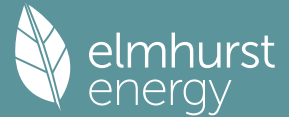
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9909	0.9721	0.9029	0.7248	0.5194	0.3539	0.2929	0.3033	0.4895	0.8335	0.9678	0.9926 (94)
Useful gains	1615.7107	1922.6103	2260.1065	2297.1948	1861.6136	1329.1058	974.7038	933.3402	1272.1699	1665.8734	1599.7048	1488.0753 (95)
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000 (96)
Heat loss rate W	3108.3537	2977.1456	2782.5322	2414.7938	1876.2431	1330.1615	974.9472	933.6282	1279.1461	1876.9011	2408.0290	2968.9801 (97)
Space heating kWh	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931 (98a)
Space heating requirement - total per year (kWh/year)												4144.2056
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	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4144.2056
Space heating per m ²										(98c) / (4) =		13.9002 (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 %)												407.8380 (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	1110.5264	708.6477	388.6847	84.6712	10.8843	0.0000	0.0000	0.0000	0.0000	157.0046	581.9934	1101.7931 (98)
Space heating efficiency (main heating system 1)	407.8380	407.8380	407.8380	407.8380	407.8380	0.0000	0.0000	0.0000	0.0000	407.8380	407.8380	407.8380 (210)
Space heating fuel (main heating system)	272.2960	173.7572	95.3037	20.7610	2.6688	0.0000	0.0000	0.0000	0.0000	38.4968	142.7021	270.1546 (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	303.0523	267.9488	284.3403	249.0440	240.8101	216.3161	212.9117	221.6826	224.4831	251.1438	268.0854	299.6009 (64)
Efficiency of water heater (217)m	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324	192.1324 (216)
												192.1324 (217)

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Fuel for water heating, kWh/month	157.7310	139.4605	147.9919	129.6210	125.3355	112.5870	110.8151	115.3801	116.8377	130.7139	139.5316	155.9346	(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	97.8414	88.3729	97.8414	94.6852	97.8414	94.6852	97.8414	97.8414	94.6852	97.8414	94.6852	97.8414	(231)
Lighting	57.7463	46.3263	41.7117	30.5597	23.6052	19.2857	21.5335	27.9900	36.3563	47.7014	53.8786	59.3513	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-182.7263	-249.4370	-392.4876	-471.3034	-515.6746	-499.4188	-470.5603	-454.5421	-393.0856	-303.6509	-204.1968	-152.8099	(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	-11.4354	-27.7692	-81.7590	-173.8850	-256.0613	-292.7968	-244.7802	-215.2951	-138.7815	-57.2185	-18.8979	-8.0219	(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												1016.1401	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												192.1324	
Water heating fuel used												1581.9398	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4140)													
mechanical ventilation fans (SFP = 1.4140)													
Total electricity for the above, kWh/year												1152.0032	(230a)
Electricity for lighting (calculated in Appendix L)												466.0460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5816.5951	(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												-1600.4659	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1016.1401	25.1600	255.6609	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1581.9398	25.1600	398.0161	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	1152.0032	25.1600	289.8440	(249)
Energy for lighting	466.0460	25.1600	117.2572	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4289.8933	25.1600	-1079.3372	
PV Unit electricity exported	-1526.7018	5.8100	-88.7014	
Total			-1168.0385	(252)
Total energy cost			-107.2604	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg	
Space heating - main system 1	1016.1401	0.1584	160.9067	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1581.9398	0.1410	222.9981	(264)
Space and water heating			383.9048	(265)
Pumps, fans and electric keep-hot	1152.0032	0.1387	159.7971	(267)
Energy for lighting	466.0460	0.1443	67.2648	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4289.8933	0.1336	-573.2762	
PV Unit electricity exported	-1526.7018	0.1199	-182.9765	
Total			-756.2527	(269)
Total CO2, kg/year			-145.2860	(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	1016.1401	1.5861	1611.7393	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1581.9398	1.5212	2406.5110	(278)
Space and water heating			4018.2503	(279)
Pumps, fans and electric keep-hot	1152.0032	1.5128	1742.7505	(281)
Energy for lighting	466.0460	1.5338	714.8369	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-4289.8933	1.4938	-6408.3418	
PV Unit electricity exported	-1526.7018	0.4397	-671.3634	
Total			-7079.7052	(283)
Total Primary energy kWh/year			-603.8675	(286)