

Full SAP Calculation Printout



Plot Reference	Finchampstead Rd - Plot 3			Issued on Date	14/12/2025
Assessment Reference	Plot 3	Plot Type Ref			
Plot Address	Plot 3, 58, Finchampstead Road, Wokingham, RG40 2NS			SAP Version	10.2
SAP Rating	82 B	DER	3.28	TER	7.58
Environmental	96 A	% DER < TER			56.73
CO ₂ Emissions (t/year)	1.01	DFEE	39.35	TFEE	40.88
Compliance Check	See BREL	% DFEE < TFEE			3.73
% DPER < TPER	15.75	DPER	34.04	TPER	40.40
Assessor Details	Mr. Steven Leahy			Assessor ID	A593-0001
Client	0864, Harding Rose Architects				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 928.0590 (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	8 * 10 = 80.0000 (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) =	80.0000 / (5) = 0.0862 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3362 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2858 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3644	0.3572	0.3501	0.3143	0.3072	0.2715	0.2715	0.2643	0.2858	0.3072	0.3215	0.3358 (22b)
Effective ac	0.5664	0.5638	0.5613	0.5494	0.5472	0.5369	0.5369	0.5349	0.5408	0.5472	0.5517	0.5564 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			44.8700	1.3258	59.4867		(27)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000 (28a)
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000 (28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000 (29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800 (29a)
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600 (30)
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800 (30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400 (30)
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000 (30)
Total net area of external elements A _{um} (A, m ²)			684.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	161.9782		(33)
Main dwelling							
Internal Walls			454.6800			9.0000	4092.1200 (32c)
First Floor			119.8200			18.0000	2156.7600 (32d)
Second Floor			61.0200			18.0000	1098.3600 (32d)
Ground Floor Ceiling			119.8200			9.0000	1078.3800 (32e)

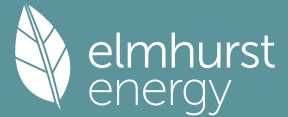
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	173.4588	172.6694	171.8956	168.2612	167.5813	164.4158	164.4158	163.8296	165.6351	167.5813	168.9568	170.3950 (38)
Heat transfer coeff												
	347.0172	346.2278	345.4540	341.8197	341.1397	337.9743	337.9743	337.3881	339.1935	341.1397	342.5153	343.9534 (39)
Average = Sum(39)m / 12 =												341.8164
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.0474	1.0450	1.0427	1.0317	1.0296	1.0201	1.0201	1.0183	1.0238	1.0296	1.0338	1.0381 (40)
HLP (average)												1.0317
Days in mopt	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers	106.4453	104.8456	102.5146	98.0546	94.7632	91.0927	89.0064	91.3198	93.8557	97.7967	102.3525	106.0375 (42)
Hot water usage for baths	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011 (42b)
Hot water usage for other uses	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211 (42c)
Average daily hot water use (litres/day)												171.9565 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	186.9805	183.1710	178.4277	170.9657	164.9960	158.5422	155.8781	160.5989	165.6038	172.4031	179.9874	186.4597 (44)
Energy content (annual)	296.1313	260.8331	274.2367	234.0435	222.1164	194.9462	188.5210	198.8549	204.2061	233.9493	256.4250	291.9508 (45)
Distribution loss (46)m = 0.15 x (45)m	44.4197	39.1250	41.1355	35.1065	33.3175	29.2419	28.2781	29.8282	30.6309	35.0924	38.4638	43.7926 (46)
Water storage loss (or HIU loss):												250.0000 (47)
Store volume												2.0800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1232 (55)
Enter (49) or (54) in (55)												1.1232 (55)
Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (64)
12Total per year (kWh/year)												3540.0784 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	144.9289	128.6957	137.6490	122.7859	120.3190	109.7860	109.1485	112.5845	112.8649	124.2534	130.2277	143.5389 (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	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	263.3495	291.5655	263.3495	272.1278	263.3495	272.1278	263.3495	263.3495	272.1278	263.3495	272.1278	263.3495 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	483.1593	488.1730	475.5387	448.6417	414.6891	382.7785	361.4602	356.4465	369.0809	395.9778	429.9304	461.8411 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632 (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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)	194.7970	191.5114	185.0121	170.5359	161.7191	152.4806	146.7050	151.3233	156.7568	167.0073	180.8718	192.9286 (72)
Total internal gains	1011.8955	1041.8396	994.4899	961.8951	910.3474	877.9765	842.1044	841.7090	868.5552	896.9243	953.5197	988.7089 (73)

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

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North	17.2200	10.6334	0.7600	0.7000	0.7700	67.5072 (74)
East	2.6400	19.6403	0.7600	0.7000	0.7700	19.1160 (76)
South	23.6900	46.7521	0.7600	0.7000	0.7700	408.3295 (78)
West	1.3200	19.6403	0.7600	0.7000	0.7700	9.5580 (80)

Solar gains	504.5106	853.8404	1163.4491	1449.6269	1642.7272	1642.3324	1578.3747	1430.4960	1260.8716	941.4245	603.0415	432.6916 (83)
Total gains	1516.4060	1895.6800	2157.9391	2411.5220	2553.0746	2520.3089	2420.4791	2272.2050	2129.4267	1838.3488	1556.5612	1421.4005 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.9428	30.0111	30.0783	30.3981	30.4587	30.7440	30.7440	30.7974	30.6335	30.4587	30.3364	30.2096
alpha	2.9962	3.0007	3.0052	3.0265	3.0306	3.0496	3.0496	3.0532	3.0422	3.0306	3.0224	3.0140
util living area	0.9866	0.9737	0.9531	0.9081	0.8267	0.6929	0.5521	0.5971	0.7869	0.9293	0.9768	0.9890 (86)
Living	18.9931	19.2447	19.5879	20.0319	20.4255	20.7129	20.8319	20.8120	20.6023	20.0790	19.4564	18.9551
Non living	17.6554	17.9768	18.4131	18.9753	19.4541	19.7840	19.8973	19.8837	19.6693	19.0431	18.2552	17.6121
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	12	0	0	0	0	0	0	0	0	0	0	0
16 / 9	19	28	8	0	0	0	0	0	0	0	0	31
MIT	20.3033	20.0059	19.7459	20.0319	20.4255	20.7129	20.8319	20.8120	20.6023	20.0790	19.4564	19.8418 (87)
Th 2	20.0440	20.0460	20.0479	20.0570	20.0587	20.0666	20.0666	20.0681	20.0636	20.0587	20.0553	20.0517 (88)
util rest of house	0.9844	0.9693	0.9449	0.8909	0.7918	0.6270	0.4552	0.5022	0.7330	0.9128	0.9722	0.9871 (89)
MIT 2	19.3979	19.1327	18.6488	18.9753	19.4541	19.7840	19.8973	19.8837	19.6693	19.0431	18.2552	18.9749 (90)
Living area fraction									fLA = Living area / (4) =			0.0761 (91)
MIT	19.4667	19.1991	18.7323	19.0557	19.5279	19.8547	19.9684	19.9543	19.7403	19.1219	18.3466	19.0409 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4667	19.1991	18.7323	19.0557	19.5279	19.8547	19.9684	19.9543	19.7403	19.1219	18.3466	19.0409 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9828	0.9646	0.9303	0.8682	0.7685	0.6102	0.4441	0.4895	0.7110	0.8912	0.9604	0.9846 (94)
Useful gains	1490.2834	1828.6116	2007.6185	2093.7791	1962.1042	1537.9029	1075.0096	1112.1905	1513.9418	1638.2830	1494.9834	1399.5194 (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	5263.1195	4950.7567	4225.6853	3471.4038	2670.4220	1775.9447	1138.4330	1199.1767	1913.1432	2907.1423	3852.1209	5104.5618 (97)
Space heating kWh	2806.9900	2098.0815	1650.2418	991.8897	526.9884	0.0000	0.0000	0.0000	0.0000	944.0313	1697.1390	2756.5515 (98a)
Space heating requirement - total per year (kWh/year)												13471.9133
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	2806.9900	2098.0815	1650.2418	991.8897	526.9884	0.0000	0.0000	0.0000	0.0000	944.0313	1697.1390	2756.5515 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13471.9133
Space heating per m2										(98c) / (4) =		40.6613 (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 %)												299.1253 (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	2806.9900	2098.0815	1650.2418	991.8897	526.9884	0.0000	0.0000	0.0000	0.0000	944.0313	1697.1390	2756.5515 (98)
Space heating efficiency (main heating system 1)	299.1253	299.1253	299.1253	299.1253	299.1253	0.0000	0.0000	0.0000	0.0000	299.1253	299.1253	299.1253 (210)
Space heating fuel (main heating system)	938.3994	701.4055	551.6891	331.5967	176.1765	0.0000	0.0000	0.0000	0.0000	315.5973	567.3672	921.5374 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (64)
Efficiency of water heater	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142 (216)
Fuel for water heating, kWh/month	220.2622	194.8173	206.6474	180.4888	174.2371	156.1766	153.3463	159.7723	161.9348	181.5952	194.4064	217.6626 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	67.5498	54.1910	48.7930	35.7478	27.6126	22.5598	25.1892	32.7419	42.5284	55.7996	63.0255	69.4273 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4503.7691	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.8142	
Water heating fuel used												2201.3470	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												545.1659	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												7250.2820	(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	4503.7691	0.1552	699.0703	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2201.3470	0.1410	310.4442	(264)
Space and water heating			1009.5146	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	545.1659	0.1443	78.6843	(268)
Total CO2, kg/year			1088.1988	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4503.7691	1.5746	7091.7831	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2201.3470	1.5215	3349.2713	(278)
Space and water heating			10441.0544	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	545.1659	1.5338	836.1936	(282)
Total Primary energy kWh/year			11277.2480	(286)
Dwelling Primary energy Rate (DPER)			34.0400	(287)

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

1. Overall dwelling characteristics

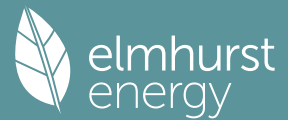
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)	
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)	
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 928.0590 (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) = 0.0431 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2931 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2491 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

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Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3176	0.3114	0.3052	0.2740	0.2678	0.2367	0.2367	0.2305	0.2491	0.2678	0.2803	0.2927 (22b)
	0.5505	0.5485	0.5466	0.5376	0.5359	0.5280	0.5280	0.5266	0.5310	0.5359	0.5393	0.5428 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			44.8700	1.1450	51.3779		(27)
Ground Floor			119.8200	0.1300	15.5766		(28)
Above Garage			30.9600	0.1300	4.0248		(28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1800	36.2574		(29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1800	18.5976		(29a)
Slope Roof	44.2400		44.2400	0.1100	4.8664		(30)
Flat Ceilings	36.9200		36.9200	0.1100	4.0612		(30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1100	9.8406		(30)
Dormer Roofs	9.0000		9.0000	0.1100	0.9900		(30)
Total net area of external elements Aum(A, m2)			684.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	149.5825	(33)

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

112.9013 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	36.7000	0.0500	1.8350
E4 Jamb	78.0000	0.0500	3.9000
E16 Corner (normal)	73.5000	0.0900	6.6150
E10 Eaves (insulation at ceiling level)	68.9000	0.0600	4.1340
E11 Eaves (insulation at rafter level)	42.6000	0.0400	1.7040
E17 Corner (inverted - internal area greater than external area)	46.9000	-0.0900	-4.2210
E14 Flat roof	19.0000	0.0800	1.5200
E3 Sill	34.8000	0.0500	1.7400
E5 Ground floor (normal)	47.4000	0.1600	7.5840
E6 Intermediate floor within a dwelling	61.8300	0.0000	0.0000

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

24.8110 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 174.3935 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	168.5806	167.9806	167.3925	164.6302	164.1134	161.7076	161.7076	161.2621	162.6343	164.1134	165.1589	166.2519 (38)
Heat transfer coeff	342.9740	342.3740	341.7859	339.0237	338.5069	336.1010	336.1010	335.6555	337.0277	338.5069	339.5524	340.6454 (39)
Average = Sum(39)m / 12 =												339.0212

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0352	1.0334	1.0316	1.0233	1.0217	1.0144	1.0144	1.0131	1.0172	1.0217	1.0248	1.0281 (40)
HLP (average)												1.0232
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

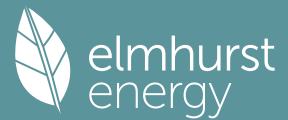
Assumed occupancy												3.1726 (42)
Hot water usage for mixer showers												
77.4148	76.2514	74.5561	71.3124	68.9187	66.2493	64.7319	66.4144	68.2587	71.1249	74.4382	77.1181	(42a)
Hot water usage for baths												
33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011	(42b)
Hot water usage for other uses												
47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211	(42c)
Average daily hot water use (litres/day)												145.1913 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.9499	154.5768	150.4692	144.2236	139.1515	133.6988	131.6036	135.6935	140.0068	145.7312	152.0731	157.5403 (44)
Energy content (annual)	250.1541	220.1153	231.2655	197.4348	187.3247	164.3982	159.1631	168.0169	172.6424	197.7559	216.6560	246.6701 (45)
Distribution loss (46)m = 0.15 x (45)m	37.5231	33.0173	34.6898	29.6152	28.0987	24.6597	23.8745	25.2025	25.8964	29.6634	32.4984	37.0005 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	305.0609	269.7085	286.1723	250.5704	242.2315	217.5338	214.0699	222.9236	225.7780	252.6627	269.7916	301.5769 (62)
WWHRS	-35.3908	-31.2999	-32.7755	-27.1394	-25.2929	-21.6433	-20.2872	-21.5734	-22.3930	-26.3989	-29.9068	-34.7354 (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	269.6701	238.4086	253.3969	223.4311	216.9386	195.8905	193.7827	201.3503	203.3850	226.2638	239.8848	266.8415 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2729.2437 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month	127.1017	112.8629	120.8212	108.1556	106.2109	97.1709	96.8472	99.7910	99.9121	109.6793	114.5466	125.9432 (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
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(66)m	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	263.3495	291.5655	263.3495	272.1278	263.3495	272.1278	263.3495	263.3495	272.1278	263.3495	272.1278	263.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	483.1593	488.1730	475.5387	448.6417	414.6891	382.7785	361.4602	356.4465	369.0809	395.9778	429.9304	461.8411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	(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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	(71)
Water heating gains (Table 5)	170.8356	167.9508	162.3941	150.2161	142.7566	134.9596	130.1709	134.1277	138.7668	147.4184	159.0925	169.2786	(72)
Total internal gains	990.9341	1021.2790	974.8720	944.5753	894.3849	860.4555	825.5703	824.5134	850.5651	880.3354	934.7404	968.0588	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W			
North					17.2200	10.6334		0.6300	0.7000			0.7700	55.9599 (74)			
East					2.6400	19.6403		0.6300	0.7000			0.7700	15.8461 (76)			
South					23.6900	46.7521		0.6300	0.7000			0.7700	338.4836 (78)			
West					1.3200	19.6403		0.6300	0.7000			0.7700	7.9231 (80)			
Solar gains					418.2127	707.7888	964.4381	1201.6644	1361.7344	1361.4071	1308.3895	1185.8059	1045.1962	780.3914	499.8896	358.6786 (83)
Total gains					1409.1468	1729.0677	1939.3100	2146.2396	2256.1193	2221.8626	2133.9598	2010.3193	1895.7613	1660.7268	1434.6300	1326.7373 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	30.2958	30.3489	30.4011	30.6488	30.6956	30.9154	30.9154	30.9564	30.8304	30.6956	30.6011	30.5029		
alpha	3.0197	3.0233	3.0267	3.0433	3.0464	3.0610	3.0610	3.0638	3.0554	3.0464	3.0401	3.0335		
util living area	0.9890	0.9792	0.9636	0.9284	0.8613	0.7414	0.6036	0.6474	0.8243	0.9438	0.9812	0.9909	(86)	
MIT	18.4297	18.7337	19.1669	19.7439	20.2822	20.6992	20.8861	20.8551	20.5449	19.8364	19.0289	18.3795	(87)	
Th 2	20.0541	20.0556	20.0571	20.0640	20.0653	20.0713	20.0713	20.0724	20.0690	20.0653	20.0627	20.0599	(88)	
util rest of house	0.9872	0.9757	0.9571	0.9143	0.8308	0.6785	0.5040	0.5518	0.7753	0.9300	0.9774	0.9893	(89)	
MIT 2	17.0009	17.3891	17.9408	18.6715	19.3335	19.8175	20.0015	19.9778	19.6541	18.7967	17.7724	16.9401	(90)	
Living area fraction									fLA = Living area / (4) =			0.0761	(91)	
MIT	17.1095	17.4913	18.0341	18.7531	19.4057	19.8845	20.0688	20.0445	19.7219	18.8758	17.8679	17.0496	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.1095	17.4913	18.0341	18.7531	19.4057	19.8845	20.0688	20.0445	19.7219	18.8758	17.8679	17.0496	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	1377.9398	1661.9543	1817.1984	1906.5134	1815.0847	1475.4856	1074.9200	1102.7404	1427.8988	1504.3730	1382.7231	1301.7978	(94)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)	
Heat loss rate W	4393.3389	4310.9454	3942.1882	3340.4352	2608.4193	1776.1326	1165.8529	1223.2997	1894.7223	2801.4068	3656.2795	4377.1472	(96)	
Space heating kWh	2243.4570	1780.1220	1580.9924	1032.4237	590.2409	0.0000	0.0000	0.0000	0.0000	964.9932	1636.9606	2288.0599	(98a)	
Space heating requirement - total per year (kWh/year)												12117.2497		
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	2243.4570	1780.1220	1580.9924	1032.4237	590.2409	0.0000	0.0000	0.0000	0.0000	964.9932	1636.9606	2288.0599	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												12117.2497		
Space heating per m2										(98c) / (4) =		36.5726	(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		
2243.4570	1780.1220	1580.9924	1032.4237	590.2409	0.0000	0.0000	0.0000	0.0000	0.0000	964.9932	1636.9606	2288.0599	(98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating fuel (main heating system)	2430.6142	1928.6262	1712.8846	1118.5522	639.4809	0.0000	0.0000	0.0000	0.0000	1045.4964	1773.5218	2478.9381	(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	269.6701	238.4086	253.3969	223.4311	216.9386	195.8905	193.7827	201.3503	203.3850	226.2638	239.8848	266.8415	(64)	
Efficiency of water heater	87.7382	87.6327	87.4378	87.0533	86.1875	79.8000	79.8000	79.8000	79.8000	86.9377	87.5381	87.7662	(216)	
Fuel for water heating, kWh/month	307.3577	272.0545	289.8025	256.6602	251.7053	245.4768	242.8355	252.3186	254.8684	260.2598	274.0346	304.0368	(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	54.7188	43.8975	39.5248	28.9576	22.3677	18.2746	20.4045	26.5226	34.4502	45.2005	51.0539	56.2396	56.2396	(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-123.0511	-163.0286	-220.1740	-231.8125	-237.0570	-216.3337	-213.1694	-207.0736	-195.1660	-178.0927	-131.2830	-107.6071	-107.6071	(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	-105.1001	-215.7769	-419.6837	-617.7228	-805.2767	-805.4298	-796.3709	-679.8197	-505.4919	-304.7431	-138.9644	-83.5653	-83.5653	(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													13128.1145	(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													3211.4107	(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)													441.6122	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-7701.7939	(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													9165.3435	(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	13128.1145	0.2100	2756.9040	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3211.4107	0.2100	674.3962	(264)
Space and water heating			3431.3003	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	441.6122	0.1443	63.7383	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2223.8486	0.1360	-302.4779	
PV Unit electricity exported	-5477.9453	0.1265	-692.9051	
Total			-995.3829	(269)
Total CO2, kg/year			2511.5849	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.5800	(273)

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

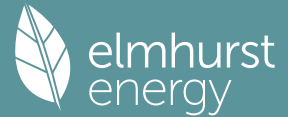
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	13128.1145	1.1300	14834.7694	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3211.4107	1.1300	3628.8941	(278)
Space and water heating			18463.6635	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	441.6122	1.5338	677.3596	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2223.8486	1.5028	-3341.9304	
PV Unit electricity exported	-5477.9453	0.4643	-2543.5763	
Total			-5885.5067	(283)
Total Primary energy kWh/year			13385.6172	(286)
Target Primary Energy Rate (TPER)			40.4000	(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)	
Main dwelling				
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)	
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)	
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 928.0590 (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) =	0.0431 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.2931 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.2491 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3176	0.3114	0.3052	0.2740	0.2678	0.2367	0.2367	0.2305	0.2491	0.2678	0.2803	0.2927 (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	0.5505	0.5485	0.5466	0.5376	0.5359	0.5280	0.5280	0.5266	0.5310	0.5359	0.5393	0.5428 (25)

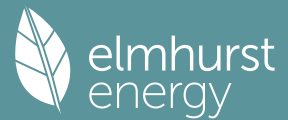
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K		
Main dwelling									
Entrance Door			2.1000	1.4000	2.9400			(26a)	
Windows			44.8700	1.3258	59.4867			(27)	
House to Garage Door			1.8900	1.4000	2.6460			(26)	
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000	(28a)	
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000	(28b)	
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000	(29a)	
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800	(29a)	
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600	(30)	
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800	(30)	
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400	(30)	
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000	(30)	
Total net area of external elements Aum(A, m2)			684.0100					(31)	
Fabric heat loss, W/K = Sum (A x U)								(32)	
Main dwelling								(33)	
Internal Walls			454.6800			9.0000	4092.1200	(32c)	
First Floor			119.8200			18.0000	2156.7600	(32d)	
Second Floor			61.0200			18.0000	1098.3600	(32d)	
Ground Floor Ceiling			119.8200			9.0000	1078.3800	(32e)	
First Floor Ceiling			61.0200			9.0000	549.1800	(32e)	
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =				37406.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									112.9013 (35)
List of Thermal Bridges									
K1 Element				Length	Psi-value	Total			
E2 Other lintels (including other steel lintels)				36.7000	0.0380	1.3946			
E4 Jamb				78.0000	0.0160	1.2480			
E16 Corner (normal)				73.5000	0.0390	2.8665			
E10 Eaves (insulation at ceiling level)				68.9000	0.0610	4.2029			
E11 Eaves (insulation at rafter level)				42.6000	0.0100	0.4260			
E17 Corner (inverted - internal area greater than external area)				46.9000	-0.0910	-4.2679			
E14 Flat roof				19.0000	0.1600	3.0400			
E3 Sill				34.8000	0.0210	0.7308			
E5 Ground floor (normal)				47.4000	0.0370	1.7538			
E6 Intermediate floor within a dwelling				61.8300	0.0030	0.1855			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									11.5802 (36)
Point Thermal bridges					(36a) =				0.0000
Total fabric heat loss					(33) + (36) + (36a) =				173.5584 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1726 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011 (42b)
Hot water usage for other uses	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211 (42c)
Average daily hot water use (litres/day)												73.8175 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	80.5352	78.3254	75.9131	72.9111	70.2328	67.4495	66.8716	69.2791	71.7481	74.6064	77.6349	80.4222 (44)

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Energy content (annual)	127.5480	111.5344	116.6756	99.8117	94.5469	82.9370	80.8755	85.7820	88.4726	101.2401	110.6051	125.9217 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1225.9506
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	108.4158	94.8042	99.1743	84.8399	80.3648	70.4965	68.7441	72.9147	75.2017	86.0541	94.0144	107.0335 (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	108.4158	94.8042	99.1743	84.8399	80.3648	70.4965	68.7441	72.9147	75.2017	86.0541	94.0144	107.0335 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1042.0580 (64)
Electric shower(s)	61.9963	55.2392	60.3191	57.5618	58.6419	55.9387	57.8033	58.6419	57.5618	60.3191	59.1849	61.9963 (64a)
Heat gains from water heating, kWh/month	42.6030	37.5109	39.8734	35.6004	34.7517	31.6088	31.6369	32.8891	33.1909	36.5933	38.2998	705.2045 (64a)
												42.2574 (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	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	263.3495	291.5655	263.3495	272.1278	263.3495	272.1278	263.3495	263.3495	272.1278	263.3495	272.1278	263.3495 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	483.1593	488.1730	475.5387	448.6417	414.6891	382.7785	361.4602	356.4465	369.0809	395.9778	429.9304	461.8411 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632 (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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)	57.2621	55.8197	53.5932	49.4450	46.7093	43.9011	42.5227	44.2058	46.0984	49.1846	53.1942	56.7976 (72)
Total internal gains	874.3606	906.1479	863.0711	840.8043	795.3376	769.3971	737.9221	734.5916	757.8968	779.1015	825.8421	852.5779 (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
North	17.2200	10.6334	0.7600	0.7000	0.7700	67.5072 (74)
East	2.6400	19.6403	0.7600	0.7000	0.7700	19.1160 (76)
South	23.6900	46.7521	0.7600	0.7000	0.7700	408.3295 (78)
West	1.3200	19.6403	0.7600	0.7000	0.7700	9.5580 (80)

Solar gains	504.5106	853.8404	1163.4491	1449.6269	1642.7272	1642.3324	1578.3747	1430.4960	1260.8716	941.4245	603.0415	432.6916 (83)
Total gains	1378.8712	1759.9883	2026.5202	2290.4311	2438.0648	2411.7295	2316.2967	2165.0875	2018.7684	1720.5261	1428.8836	1285.2695 (84)

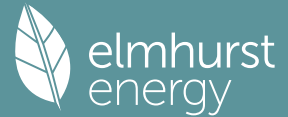
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.3698	30.4231	30.4756	30.7245	30.7715	30.9924	30.9924	31.0336	30.9069	30.7715	30.6766	30.5779
alpha	3.0247	3.0282	3.0317	3.0483	3.0514	3.0662	3.0662	3.0689	3.0605	3.0514	3.0451	3.0385
util living area	0.9897	0.9782	0.9594	0.9170	0.8390	0.7084	0.5679	0.6151	0.8034	0.9388	0.9814	0.9916 (86)
MIT	18.4186	18.7567	19.2174	19.8131	20.3472	20.7387	20.9045	20.8753	20.5832	19.8692	19.0310	18.3618 (87)
Th 2	20.0562	20.0577	20.2092	20.0661	20.0674	20.0734	20.0734	20.0745	20.0711	20.0674	20.0648	20.0620 (88)
util rest of house	0.9879	0.9745	0.9522	0.9013	0.8056	0.6436	0.4704	0.5201	0.7516	0.9241	0.9777	0.9902 (89)
MIT 2	17.6650	18.0017	18.4586	19.0459	19.5539	19.9043	20.0287	20.0122	19.7784	19.1093	18.2813	17.6124 (90)
Living area fraction	17.7223	18.0591	18.5163	19.1042	19.6142	19.9677	20.0953	20.0779	19.8396	19.1671	18.3383	17.6694 (91)
MIT	17.7223	18.0591	18.5163	19.1042	19.6142	19.9677	20.0953	20.0779	19.8396	19.1671	18.3383	17.6694 (92)
Temperature adjustment	17.7223	18.0591	18.5163	19.1042	19.6142	19.9677	20.0953	20.0779	19.8396	19.1671	18.3383	17.6694 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9815	0.9636	0.9365	0.8810	0.7866	0.6353	0.4729	0.5205	0.7364	0.9055	0.9678	0.9847 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	4592.3017	4494.3518	4096.9744	3450.9533	2672.4045	1799.6232	1171.8476	1231.4299	1929.6224	2892.8582	3806.6049	4577.0349 (97)
Space heating kWh	2409.8064	1880.5621	1636.2023	1031.8878	561.4747	0.0000	0.0000	0.0000	0.0000	993.2110	1745.1079	2463.6607 (98a)
Space heating requirement - total per year (kWh/year)												12721.9128
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	2409.8064	1880.5621	1636.2023	1031.8878	561.4747	0.0000	0.0000	0.0000	0.0000	993.2110	1745.1079	2463.6607 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12721.9128

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Space heating per m2

(98c) / (4) = 38.3977 (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	3151.5005	2480.9685	2544.6357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6898	0.7675	0.7319	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2173.8188	1904.2476	1862.5293	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2678.5250	2572.4282	2401.2484	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	363.3885	497.1264	400.8070	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =				(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	90.8471	124.2816	100.2017	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												315.3305	(107)
Energy for space heating												38.3977	(99)
Energy for space cooling												0.9517	(108)
Total												39.3494	(109)
Fabric Energy Efficiency (DFEE)												39.3	(109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	928.0590 (5)

2. Ventilation rate

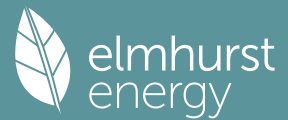
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0431 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2931 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2491 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3176	0.3114	0.3052	0.2740	0.2678	0.2367	0.2367	0.2305	0.2491	0.2678	0.2803	0.2927	(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	0.5505	0.5485	0.5466	0.5376	0.5359	0.5280	0.5280	0.5266	0.5310	0.5359	0.5393	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)
TER Opening Type			44.8700	1.1450	51.3779			(27)
Ground Floor			119.8200	0.1300	15.5766			(28a)
Above Garage			30.9600	0.1300	4.0248			(28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1800	36.2574			(29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1800	18.5976			(29a)
Slope Roof	44.2400		44.2400	0.1100	4.8664			(30)
Flat Ceilings	36.9200		36.9200	0.1100	4.0612			(30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1100	9.8406			(30)
Dormer Roofs	9.0000		9.0000	0.1100	0.9900			(30)
Total net area of external elements Aum(A, m2)			684.0100					(31)

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Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 149.5825 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.9013 (35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	36.7000	0.0500	1.8350
E4 Jamb	78.0000	0.0500	3.9000
E16 Corner (normal)	73.5000	0.0900	6.6150
E10 Eaves (insulation at ceiling level)	68.9000	0.0600	4.1340
E11 Eaves (insulation at rafter level)	42.6000	0.0400	1.7040
E17 Corner (inverted - internal area greater than external area)	46.9000	-0.0900	-4.2210
E14 Flat roof	19.0000	0.0800	1.5200
E3 Sill	34.8000	0.0500	1.7400
E5 Ground floor (normal)	47.4000	0.1600	7.5840
E6 Intermediate floor within a dwelling	61.8300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			24.8110 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			174.3935 (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	168.5806	167.9806	167.3925	164.6302	164.1134	161.7076	161.7076	161.2621	162.6343	164.1134	165.1589	166.2519 (38)
Average = Sum(39)m / 12 =	342.9740	342.3740	341.7859	339.0237	338.5069	336.1010	336.1010	335.6555	337.0277	338.5069	339.5524	340.6454 (39)
												339.0212
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0352	1.0334	1.0316	1.0233	1.0217	1.0144	1.0144	1.0131	1.0172	1.0217	1.0248	1.0281 (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												3.1726 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011 (42b)
Hot water usage for other uses	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211 (42c)
Average daily hot water use (litres/day)												73.8175 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	80.5352	78.3254	75.9131	72.9111	70.2328	67.4495	66.8716	69.2791	71.7481	74.6064	77.6349	80.4222 (44)
Energy content (annual)	127.5480	111.5344	116.6756	99.8117	94.5469	82.9370	80.8755	85.7820	88.4726	101.2401	110.6051	125.9217 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (62)
Total heat required for water heating calculated for each month	108.4158	94.8042	99.1743	84.8399	80.3648	70.4965	68.7441	72.9147	75.2017	86.0541	94.0144	107.0335 (63a)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64)
Output from w/h	108.4158	94.8042	99.1743	84.8399	80.3648	70.4965	68.7441	72.9147	75.2017	86.0541	94.0144	107.0335 (64)
12Total per year (kWh/year)												1042.0580 (64)
Electric shower(s)	61.9963	55.2392	60.3191	57.5618	58.6419	55.9387	57.8033	58.6419	57.5618	60.3191	59.1849	61.9963 (64a)
Heat gains from water heating, kWh/month	42.6030	37.5109	39.8734	35.6004	34.7517	31.6088	31.6369	32.8891	33.1909	36.5933	38.2998	42.2574 (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	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323	158.6323 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	263.3495	291.5655	263.3495	272.1278	263.3495	272.1278	263.3495	263.3495	272.1278	263.3495	272.1278	263.3495 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	483.1593	488.1730	475.5387	448.6417	414.6891	382.7785	361.4602	356.4465	369.0809	395.9778	429.9304	461.8411 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632	38.8632 (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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)	57.2621	55.8197	53.5932	49.4450	46.7093	43.9011	42.5227	44.2058	46.0984	49.1846	53.1942	56.7976 (72)
Total internal gains	874.3606	906.1479	863.0711	840.8043	795.3376	769.3971	737.9221	734.5916	757.8968	779.1015	825.8421	852.5779 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.2200	10.6334	0.6300	0.7000	0.7700	55.9599 (74)
East	2.6400	19.6403	0.6300	0.7000	0.7700	15.8461 (76)
South	23.6900	46.7521	0.6300	0.7000	0.7700	338.4836 (78)
West	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (80)

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Solar gains	418.2127	707.7888	964.4381	1201.6644	1361.7344	1361.4071	1308.3895	1185.8059	1045.1962	780.3914	499.8896	358.6786 (83)
Total gains	1292.5733	1613.9367	1827.5091	2042.4686	2157.0720	2130.8042	2046.3116	1920.3974	1803.0930	1559.4929	1325.7317	1211.2564 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.2958	30.3489	30.4011	30.6488	30.6956	30.9154	30.9154	30.9564	30.8304	30.6956	30.6011	30.5029
alpha	3.0197	3.0233	3.0267	3.0433	3.0464	3.0610	3.0610	3.0638	3.0554	3.0464	3.0401	3.0335
util living area	0.9913	0.9826	0.9686	0.9361	0.8730	0.7573	0.6215	0.6666	0.8396	0.9516	0.9848	0.9929 (86)
MIT	18.3631	18.6701	19.1084	19.6958	20.2464	20.6791	20.8763	20.8424	20.5158	19.7868	18.9682	18.3130 (87)
Th 2	20.0541	20.0556	20.0571	20.0640	20.0653	20.0713	20.0713	20.0724	20.0690	20.0653	20.0627	20.0599 (88)
util rest of house	0.9898	0.9796	0.9629	0.9232	0.8442	0.6958	0.5213	0.5711	0.7930	0.9395	0.9817	0.9917 (89)
MIT 2	17.6085	17.9147	18.3506	18.9332	19.4632	19.8585	20.0116	19.9912	19.7218	19.0293	18.2178	17.5624 (90)
Living area fraction	17.6659	17.9722	18.4083	18.9912	19.5228	19.9209	20.0774	20.0560	19.7822	19.0869	18.2749	17.6195 (91)
MIT	17.6659	17.9722	18.4083	18.9912	19.5228	19.9209	20.0774	20.0560	19.7822	19.0869	18.2749	17.6195 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6659	17.9722	18.4083	18.9912	19.5228	19.9209	20.0774	20.0560	19.7822	19.0869	18.2749	17.6195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9842	0.9702	0.9492	0.9042	0.8239	0.6843	0.5220	0.5692	0.7756	0.9224	0.9730	0.9869 (94)
Useful gains	1272.1544	1565.8864	1734.5903	1846.8905	1777.3116	1458.1442	1068.1531	1093.0905	1398.5148	1438.4209	1289.9513	1195.3399 (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	4584.1492	4475.5655	4070.0832	3421.1463	2648.0595	1788.3605	1168.7428	1227.1469	1915.0659	2872.8897	3794.4531	4571.2851 (97)
Space heating kWh	2464.1241	1955.3043	1737.6067	1133.4642	647.8364	0.0000	0.0000	0.0000	0.0000	1067.2448	1803.2413	2511.7032 (98a)
Space heating requirement - total per year (kWh/year)												13320.5250
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	2464.1241	1955.3043	1737.6067	1133.4642	647.8364	0.0000	0.0000	0.0000	0.0000	1067.2448	1803.2413	2511.7032 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13320.5250
Space heating per m2												(98c) / (4) = 40.2044 (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	3159.3498	2487.1477	2550.9820	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6337	0.7160	0.6795	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2002.1861	1780.8207	1733.2842	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2350.1708	2256.8612	2115.2469	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	250.5490	354.1741	284.1802	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	62.6373	88.5435	71.0451	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												222.2259 (107)
Energy for space heating												40.2044 (99)
Energy for space cooling												0.6707 (108)
Total												40.8751 (109)
Fabric Energy Efficiency (TFEE)												40.9 (109)

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

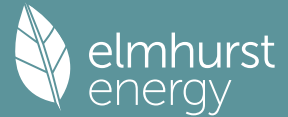
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b) =	293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c) =	451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d) =	183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	928.0590 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)

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Number of chimneys / flues attached to closed fire
Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
8 * 10 = 80.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 80.0000 / (5) = 0.0862 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.3362 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2858 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3644	0.3572	0.3501	0.3143	0.3072	0.2715	0.2715	0.2643	0.2858	0.3072	0.3215	0.3358	(22b)
Effective ac	0.5664	0.5638	0.5613	0.5494	0.5472	0.5369	0.5369	0.5349	0.5408	0.5472	0.5517	0.5564	(25)

3. Heat losses and heat loss parameter

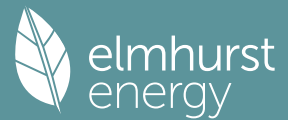
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Entrance Door			2.1000	1.4000	2.9400			(26a)
Windows			44.8700	1.3258	59.4867			(27)
House to Garage Door			1.8900	1.4000	2.6460			(26)
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000	(28a)
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000	(28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000	(29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800	(29a)
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600	(30)
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800	(30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400	(30)
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000	(30)
Total net area of external elements Aum (A, m2)			684.0100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 161.9782			(33)
Main dwelling								
Internal Walls			454.6800			9.0000	4092.1200	(32c)
First Floor			119.8200			18.0000	2156.7600	(32d)
Second Floor			61.0200			18.0000	1098.3600	(32d)
Ground Floor Ceiling			119.8200			9.0000	1078.3800	(32e)
First Floor Ceiling			61.0200			9.0000	549.1800	(32e)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(28)...(30) + (32) + (32a)...(32e) = 37406.4600 (34)
List of Thermal Bridges								112.9013 (35)
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				36.7000	0.0380		1.3946	
E4 Jamb				78.0000	0.0160		1.2480	
E16 Corner (normal)				73.5000	0.0390		2.8665	
E10 Eaves (insulation at ceiling level)				68.9000	0.0610		4.2029	
E11 Eaves (insulation at rafter level)				42.6000	0.0100		0.4260	
E17 Corner (inverted - internal area greater than external area)				46.9000	-0.0910		-4.2679	
E14 Flat roof				19.0000	0.1600		3.0400	
E3 Sill				34.8000	0.0210		0.7308	
E5 Ground floor (normal)				47.4000	0.0370		1.7538	
E6 Intermediate floor within a dwelling				61.8300	0.0030		0.1855	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.5802 (36)
Point Thermal bridges							(36a) = 0.0000	
Total fabric heat loss							(33) + (36) + (36a) = 173.5584	(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	
	173.4588	172.6694	171.8956	168.2612	167.5813	164.4158	164.4158	163.8296	165.6351	167.5813	168.9568	170.3950	(38)
Heat transfer coeff	347.0172	346.2278	345.4540	341.8197	341.1397	337.9743	337.9743	337.3881	339.1935	341.1397	342.5153	343.9534	(39)
Average = Sum(39)m / 12 =												341.8164	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0474	1.0450	1.0427	1.0317	1.0296	1.0201	1.0201	1.0183	1.0238	1.0296	1.0338	1.0381	(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													3.1726 (42)
Hot water usage for mixer showers													
	106.4453	104.8456	102.5146	98.0546	94.7632	91.0927	89.0064	91.3198	93.8557	97.7967	102.3525	106.0375	(42a)
Hot water usage for baths													
	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011	(42b)
Hot water usage for other uses													
	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211	(42c)
Average daily hot water use (litres/day)													171.9565 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	186.9805	183.1710	178.4277	170.9657	164.9960	158.5422	155.8781	160.5989	165.6038	172.4031	179.9874	186.4597	(44)
Energy conte	296.1313	260.8331	274.2367	234.0435	222.1164	194.9462	188.5210	198.8549	204.2061	233.9493	256.4250	291.9508	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													2856.2144
	44.4197	39.1250	41.1355	35.1065	33.3175	29.2419	28.2781	29.8282	30.6309	35.0924	38.4638	43.7926	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0800 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1232 (55)

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Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (64)
	Total per year (kWh/year) = Sum(64)m = 3540.0784 (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	144.9289	128.6957	137.6490	122.7859	120.3190	109.7860	109.1485	112.5845	112.8649	124.2534	130.2277	143.5389 (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	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.1739	68.5451	55.7447	42.2023	31.5467	26.6331	28.7780	37.4067	50.2072	63.7495	74.4051	79.3188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	721.1333	728.6164	709.7592	669.6145	618.9390	571.3112	539.4929	532.0098	550.8670	591.0117	641.6872	689.3150 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085 (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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)	194.7970	191.5114	185.0121	170.5359	161.7191	152.4806	146.7050	151.3233	156.7568	167.0073	180.8718	192.9286 (72)
Total internal gains	1113.7656	1109.3344	1071.1774	1003.0142	932.8662	871.0862	835.6373	841.4012	878.4924	942.4300	1017.6256	1082.2239 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				17.2200	10.6334	0.7600	0.7000	0.7700	67.5072 (74)			
East				2.6400	19.6403	0.7600	0.7000	0.7700	19.1160 (76)			
South				23.6900	46.7521	0.7600	0.7000	0.7700	408.3295 (78)			
West				1.3200	19.6403	0.7600	0.7000	0.7700	9.5580 (80)			
Solar gains	504.5106	853.8404	1163.4491	1449.6269	1642.7272	1642.3324	1578.3747	1430.4960	1260.8716	941.4245	603.0415	432.6916 (83)
Total gains	1618.2762	1963.1748	2234.6265	2452.6411	2575.5934	2513.4186	2414.0119	2271.8972	2139.3640	1883.8545	1620.6671	1514.9155 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.9428	30.0111	30.0783	30.3981	30.4587	30.7440	30.7440	30.7974	30.6335	30.4587	30.3364	30.2096
alpha	2.9962	3.0007	3.0052	3.0265	3.0306	3.0496	3.0496	3.0532	3.0422	3.0306	3.0224	3.0140
util living area	0.9841	0.9713	0.9490	0.9047	0.8240	0.6940	0.5532	0.5972	0.7853	0.9253	0.9743	0.9869 (86)
Living	19.0358	19.2717	19.6163	20.0448	20.4306	20.7121	20.8315	20.8120	20.6042	20.0945	19.4824	18.9948
Non living	17.7098	18.0109	18.4485	18.9908	19.4598	19.7832	19.8971	19.8837	19.6713	19.0617	18.2880	17.6627
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	12	0	0	0	0	0	0	0	0	0	0	0
16 / 9	19	28	8	0	0	0	0	0	0	0	0	31
MIT	20.3182	20.0212	19.7711	20.0448	20.4306	20.7121	20.8315	20.8120	20.6042	20.0945	19.4824	19.8643 (87)
Th 2	20.0440	20.0460	20.0479	20.0570	20.0587	20.0666	20.0666	20.0681	20.0636	20.0587	20.0553	20.0517 (88)
util rest of house	0.9815	0.9665	0.9402	0.8871	0.7887	0.6282	0.4562	0.5023	0.7311	0.9080	0.9692	0.9847 (89)
MIT 2	19.4126	19.1478	18.6791	18.9908	19.4598	19.7832	19.8971	19.8837	19.6713	19.0617	18.2880	18.9972 (90)
Living area fraction	fLA = Living area / (4) = 0.0761 (91)											
MIT	19.4814	19.2142	18.7621	19.0710	19.5336	19.8539	19.9681	19.9543	19.7422	19.1403	18.3789	19.0632 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4814	19.2142	18.7621	19.0710	19.5336	19.8539	19.9681	19.9543	19.7422	19.1403	18.3789	19.0632 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9796	0.9615	0.9251	0.8642	0.7656	0.6113	0.4451	0.4895	0.7092	0.8861	0.9567	0.9819 (94)
Useful gains	1585.3383	1887.6797	2067.2247	2119.6316	1971.8350	1536.4593	1074.5361	1112.1593	1517.3128	1669.2344	1550.4141	1487.4357 (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	5268.2236	4955.9741	4235.9986	3476.6463	2672.3589	1775.6710	1138.3448	1199.1708	1913.8048	2913.4235	3863.1867	5112.2429 (97)
Space heating kWh	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565 (98a)
Space heating requirement - total per year (kWh/year)	13201.4980											
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	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	13201.4980											
Space heating per m2	(98c) / (4) = 39.8452 (99)											

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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 %)												299.1253 (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	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565 (98)
Space heating efficiency (main heating system 1)	299.1253	299.1253	299.1253	299.1253	299.1253	0.0000	0.0000	0.0000	0.0000	299.1253	299.1253	299.1253 (210)
Space heating fuel (main heating system)	916.0263	689.3077	539.4287	326.6359	174.2379	0.0000	0.0000	0.0000	0.0000	309.4612	556.6885	901.5809 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (64)
Efficiency of water heater (217)m	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142 (216)
Fuel for water heating, kWh/month	220.2622	194.8173	206.6474	180.4888	174.2371	156.1766	153.3463	159.7723	161.9348	181.5952	194.4064	217.6626 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	67.5498	54.1910	48.7930	35.7478	27.6126	22.5598	25.1892	32.7419	42.5284	55.7996	63.0255	69.4273 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4413.3671 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												160.8142
Water heating fuel used												2201.3470 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												545.1659 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												7159.8800 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4413.3671	16.4900	727.7642 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2201.3470	16.4900	363.0021 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	545.1659	16.4900	89.8979 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1180.6642 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		1.1295 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	81.6914
SAP rating (Section 12)		82 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4413.3671	0.1552	684.9468 (261)
Total CO2 associated with community systems			0.0000 (373)

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Water heating (other fuel)	2201.3470	0.1410	310.4442 (264)
Space and water heating			995.3911 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	545.1659	0.1443	78.6843 (268)
Total CO ₂ , kg/year			1074.0753 (272)
CO ₂ emissions per m ²			3.2400 (273)
EI value			96.1754
EI rating			96 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 928.0590 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.0862 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3362	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2858 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.1000	3.8000	3.9000	3.5000	3.6000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Adj infilt rate	1.0250	0.9500	0.9750	0.8750	0.9000	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Effective ac	0.2929	0.2715	0.2786	0.2500	0.2572	0.2286	0.2358	0.2215	0.2215	0.2429	0.2358	0.2643 (22b)
	0.5429	0.5369	0.5388	0.5313	0.5331	0.5261	0.5278	0.5245	0.5245	0.5295	0.5278	0.5349 (25)

3. Heat losses and heat loss parameter

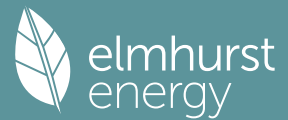
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			44.8700	1.3258	59.4867		(27)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000 (28a)
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000 (28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000 (29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800 (29a)
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600 (30)
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800 (30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400 (30)
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000 (30)
Total net area of external elements Aum(A, m ²)			684.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	161.9782		(33)
Main dwelling							
Internal Walls			454.6800			9.0000	4092.1200 (32c)
First Floor			119.8200			18.0000	2156.7600 (32d)
Second Floor			61.0200			18.0000	1098.3600 (32d)
Ground Floor Ceiling			119.8200			9.0000	1078.3800 (32e)
First Floor Ceiling			61.0200			9.0000	549.1800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 37406.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 112.9013 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	36.7000	0.0380	1.3946
E4 Jamb	78.0000	0.0160	1.2480
E16 Corner (normal)	73.5000	0.0390	2.8665
E10 Eaves (insulation at ceiling level)	68.9000	0.0610	4.2029
E11 Eaves (insulation at rafter level)	42.6000	0.0100	0.4260
E17 Corner (inverted - internal area greater than external area)	46.9000	-0.0910	-4.2679
E14 Flat roof	19.0000	0.1600	3.0400
E3 Sill	34.8000	0.0210	0.7308

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E5 Ground floor (normal)	47.4000	0.0370	1.7538
E6 Intermediate floor within a dwelling	61.8300	0.0030	0.1855
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5802 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	173.5584 (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	166.2682	164.4158	165.0176	162.7042	163.2591	161.1332	161.6412	160.6408	160.6408	162.1649	161.6412	163.8296 (38)
Average = Sum(39)m / 12 =	339.8266	337.9743	338.5761	336.2626	336.8175	334.6916	335.1996	334.1992	334.1992	335.7233	335.1996	337.3881 (39)
												336.3381
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0257	1.0201	1.0219	1.0149	1.0166	1.0102	1.0117	1.0087	1.0087	1.0133	1.0117	1.0183 (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												3.1726 (42)
Hot water usage for mixer showers												
Hot water usage for baths	106.4453	104.8456	102.5146	98.0546	94.7632	91.0927	89.0064	91.3198	93.8557	97.7967	102.3525	106.0375 (42a)
Hot water usage for other uses	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011 (42b)
Average daily hot water use (litres/day)	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211 (42c)
												171.9565 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	186.9805	183.1710	178.4277	170.9657	164.9960	158.5422	155.8781	160.5989	165.6038	172.4031	179.9874	186.4597 (44)
Energy content (annual)	296.1313	260.8331	274.2367	234.0435	222.1164	194.9462	188.5210	198.8549	204.2061	233.9493	256.4250	291.9508 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss (or HIU loss):	44.4197	39.1250	41.1355	35.1065	33.3175	29.2419	28.2781	29.8282	30.6309	35.0924	38.4638	43.7926 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1232 (55)
Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (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	144.9289	128.6957	137.6490	122.7859	120.3190	109.7860	109.1485	112.5845	112.8649	124.2534	130.2277	143.5389 (65)

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

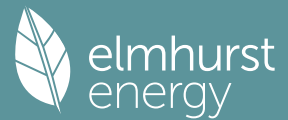
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.1739	68.5451	55.7447	42.2023	31.5467	26.6331	28.7780	37.4067	50.2072	63.7495	74.4051	79.3188 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	721.1333	728.6164	709.7592	669.6145	618.9390	571.3112	539.4929	532.0098	550.8670	591.0117	641.6872	689.3150 (68)
Pumps, fans	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085 (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)	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Total internal gains	194.7970	191.5114	185.0121	170.5359	161.7191	152.4806	146.7050	151.3233	156.7568	167.0073	180.8718	192.9286 (72)
	1113.7656	1109.3344	1071.1774	1003.0142	932.8662	871.0862	835.6373	841.4012	878.4924	942.4300	1017.6256	1082.2239 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF	Access	Gains	
				m2	Table 6a		Specific data		Specific data	factor	W	
					W/m2		or Table 6b		or Table 6c	Table 6d		
North				17.2200		12.7500	0.7600		0.7000	0.7700	80.9445 (74)	
East				2.6400		23.7835	0.7600		0.7000	0.7700	23.1486 (76)	
South				23.6900		54.0600	0.7600		0.7000	0.7700	472.1566 (78)	
West				1.3200		23.7835	0.7600		0.7000	0.7700	11.5743 (80)	
Solar gains	587.8240	884.5691	1180.5625	1505.6161	1674.9960	1769.1663	1696.9972	1568.4592	1367.7665	1029.9327	692.1122	507.1518 (83)
Total gains	1701.5896	1993.9035	2251.7400	2508.6303	2607.8623	2640.2525	2532.6344	2409.8604	2246.2589	1972.3626	1709.7378	1589.3756 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.5764	30.7440	30.6894	30.9005	30.8496	31.0455	30.9985	31.0913	31.0913	30.9501	30.9985	30.7974
alpha	3.0384	3.0496	3.0460	3.0600	3.0566	3.0697	3.0666	3.0728	3.0728	3.0633	3.0666	3.0532
util living area	0.9803	0.9678	0.9428	0.8891	0.7915	0.6292	0.4706	0.5103	0.7476	0.9066	0.9679	0.9838 (86)
Living	19.1868	19.3899	19.7299	20.1516	20.5269	20.7743	20.8631	20.8520	20.6637	20.2117	19.6131	19.1389
Non living	17.9146	18.1754	18.6040	19.1324	19.5801	19.8511	19.9270	19.9222	19.7447	19.2154	18.4664	17.8579
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	11	0	0	0	0	0	0	0	0	0	0	0
16 / 9	20	28	5	0	0	0	0	0	0	0	0	31
MIT	20.3374	20.0881	19.8187	20.1516	20.5269	20.7743	20.8631	20.8520	20.6637	20.2117	19.6131	19.9459 (87)
Th 2	20.0620	20.0666	20.0651	20.0709	20.0695	20.0749	20.0736	20.0761	20.0761	20.0723	20.0736	20.0681 (88)
util rest of house	0.9770	0.9625	0.9328	0.8687	0.7499	0.5552	0.3679	0.4082	0.6875	0.8851	0.9617	0.9811 (89)
MIT 2	19.4505	19.2319	18.7356	19.1324	19.5801	19.8511	19.9270	19.9222	19.7447	19.2154	18.4664	19.0926 (90)
Living area fraction									fLA = Living area / (4) =			0.0761 (91)
MIT	19.5180	19.2970	18.8180	19.2099	19.6522	19.9213	19.9982	19.9930	19.8146	19.2912	18.5536	19.1575 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5180	19.2970	18.8180	19.2099	19.6522	19.9213	19.9982	19.9930	19.8146	19.2912	18.5536	19.1575 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9747	0.9572	0.9159	0.8456	0.7283	0.5418	0.3591	0.3983	0.6679	0.8621	0.9475	0.9778 (94)
Useful gains	1658.6228	1908.5745	2062.3476	2121.1959	1899.3286	1430.4176	909.3634	959.8746	1500.2847	1700.4058	1619.9357	1554.0776 (95)
Ext temp.	4.8000	5.3000	7.0000	9.4000	12.4000	15.2000	17.2000	17.0000	14.4000	11.1000	7.5000	4.7000 (96)
Heat loss rate W	5001.5531	4730.6240	4001.2921	3298.7078	2442.6520	1580.1958	937.9455	1000.2423	1809.5618	2749.9755	3705.1539	4877.7803 (97)
Space heating kWh	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98a)
Space heating requirement - total per year (kWh/year)												11833.2452
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	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11833.2452
Space heating per m2										(98c) / (4) =		35.7155 (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 %)												297.7775 (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	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98)
Space heating efficiency (main heating system 1)	297.7775	297.7775	297.7775	297.7775	297.7775	0.0000	0.0000	0.0000	0.0000	297.7775	297.7775	297.7775 (210)
Space heating fuel (main heating system)	835.2345	636.8572	484.4472	284.7121	135.7499	0.0000	0.0000	0.0000	0.0000	262.2361	504.1876	830.4304 (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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324 (64)
Efficiency of water heater (217)m	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959 (216)
Fuel for water heating, kWh/month	220.2873	194.8395	206.6709	180.5093	174.2570	156.1944	153.3638	159.7905	161.9532	181.6159	194.4285	217.6874 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	67.5498	54.1910	48.7930	35.7478	27.6126	22.5598	25.1892	32.7419	42.5284	55.7996	63.0255	69.4273 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												3973.8549 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												160.7959
Water heating fuel used												2201.5979 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												545.1659 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)

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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	6720.6187 (238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3973.8549	28.4300	1129.7670 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2201.5979	28.4300	625.9143 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	545.1659	28.4300	154.9907 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1910.6719 (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	3973.8549	0.1555	617.9502 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2201.5979	0.1410	310.4796 (264)
Space and water heating			928.4298 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	545.1659	0.1443	78.6843 (268)
Total CO2, kg/year			1007.1141 (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	3973.8549	1.5757	6261.5796 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2201.5979	1.5215	3349.6529 (278)
Space and water heating			9611.2326 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	545.1659	1.5338	836.1936 (282)
Total Primary energy kWh/year			10447.4262 (286)

SAP 10 EPC IMPROVEMENTS

Plot 3

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

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 2.8	-£ 328	-154 kg (15.3%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 118	-52 kg (5.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£328	0.47 kg/m²	B 84	A 97
Total Savings	£328	0.47 kg/m²		

Potential energy efficiency rating:	B 84
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1911	Potential £1911	£0	Saving
Electricity				
Space heating	£1130	£1130	£0	
Water heating	£626	£626	£0	
Lighting	£155	£155	£0	
Generated (PV)	-£0	-£328	£328	
Total cost of fuels	£1911	£1583	£328	
Total cost of uses	£1911	£1583	£328	
Delivered energy	20 kWh/m²	17 kWh/m²	3 kWh/m²	
Carbon dioxide emissions	1.0 tonnes	0.9 tonnes	0.2 tonnes	
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²	
Primary energy	32 kWh/m²	26 kWh/m²	5 kWh/m²	

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 928.0590 (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	8 * 10 =	80.0000 (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) =	80.0000 / (5) =	0.0862 (8)	
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.3362 (18)	
Number of sides sheltered		2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2858 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3644	0.3572	0.3501	0.3143	0.3072	0.2715	0.2715	0.2643	0.2858	0.3072	0.3215	0.3358 (22b)
Effective ac	0.5664	0.5638	0.5613	0.5494	0.5472	0.5369	0.5369	0.5349	0.5408	0.5472	0.5517	0.5564 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			44.8700	1.3258	59.4867		(27)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000 (28a)
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000 (28b)
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000 (29a)
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800 (29a)
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600 (30)
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800 (30)
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400 (30)
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000 (30)
Total net area of external elements Aum(A, m ²)			684.0100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		161.9782		(33)
Main dwelling							
Internal Walls			454.6800			9.0000	4092.1200 (32c)
First Floor			119.8200			18.0000	2156.7600 (32d)
Second Floor			61.0200			18.0000	1098.3600 (32d)
Ground Floor Ceiling			119.8200			9.0000	1078.3800 (32e)
First Floor Ceiling			61.0200			9.0000	549.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 37406.4600 (34)
112.9013 (35)

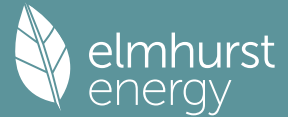
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	36.7000	0.0380	1.3946
E2 Other lintels (including other steel lintels)	78.0000	0.0160	1.2480
E4 Jamb	73.5000	0.0390	2.8665
E16 Corner (normal)	68.9000	0.0610	4.2029
E10 Eaves (insulation at ceiling level)	42.6000	0.0100	0.4260
E11 Eaves (insulation at rafter level)	46.9000	-0.0910	-4.2679
E17 Corner (inverted - internal area greater than external area)	19.0000	0.1600	3.0400
E14 Flat roof	34.8000	0.0210	0.7308
E3 Sill	47.4000	0.0370	1.7538
E5 Ground floor (normal)	61.8300	0.0030	0.1855
E6 Intermediate floor within a dwelling			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5802 (36)
Point Thermal Bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 173.5584 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	173.4588	172.6694	171.8956	168.2612	167.5813	164.4158	164.4158	163.8296	165.6351	167.5813	168.9568	170.3950 (38)
Heat transfer coeff	347.0172	346.2278	345.4540	341.8197	341.1397	337.9743	337.9743	337.3881	339.1935	341.1397	342.5153	343.9534 (39)
Average = Sum(39)m / 12 =												341.8164

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0474	1.0450	1.0427	1.0317	1.0296	1.0201	1.0201	1.0183	1.0238	1.0296	1.0338	1.0381	(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													3.1726 (42)
Hot water usage for mixer showers													
106.4453	104.8456	102.5146	98.0546	94.7632	91.0927	89.0064	91.3198	93.8557	97.7967	102.3525	106.0375	(42a)	
Hot water usage for baths													
33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011	(42b)	
Hot water usage for other uses													
47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211	(42c)	
Average daily hot water use (litres/day)												171.9565	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	186.9805	183.1710	178.4277	170.9657	164.9960	158.5422	155.8781	160.5989	165.6038	172.4031	179.9874	186.4597	(44)
Energy content	296.1313	260.8331	274.2367	234.0435	222.1164	194.9462	188.5210	198.8549	204.2061	233.9493	256.4250	291.9508	(45)
Energy content (annual)										Total = Sum(45)m =		2856.2144	
Distribution loss (46)m = 0.15 x (45)m													
44.4197	39.1250	41.1355	35.1065	33.3175	29.2419	28.2781	29.8282	30.6309	35.0924	38.4638	43.7926	(46)	
Water storage loss (or HIU loss):													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0800	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1232	(55)
Total storage loss													
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(56)	
If cylinder contains dedicated solar storage													
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(64)
								Total per year (kWh/year) = Sum(64)m =				3540.0784	(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													
144.9289	128.6957	137.6490	122.7859	120.3190	109.7860	109.1485	112.5845	112.8649	124.2534	130.2277	143.5389	(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	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	77.1739	68.5451	55.7447	42.2023	31.5467	26.6331	28.7780	37.4067	50.2072	63.7495	74.4051	79.3188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	721.1333	728.6164	709.7592	669.6145	618.9390	571.3112	539.4929	532.0098	550.8670	591.0117	641.6872	689.3150 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085 (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)												
	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)												
	194.7970	191.5114	185.0121	170.5359	161.7191	152.4806	146.7050	151.3233	156.7568	167.0073	180.8718	192.9286 (72)
Total internal gains												
	1113.7656	1109.3344	1071.1774	1003.0142	932.8662	871.0862	835.6373	841.4012	878.4924	942.4300	1017.6256	1082.2239 (73)

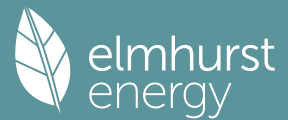
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				17.2200	10.6334	0.7600	0.7000	0.7700	67.5072 (74)				
East				2.6400	19.6403	0.7600	0.7000	0.7700	19.1160 (76)				
South				23.6900	46.7521	0.7600	0.7000	0.7700	408.3295 (78)				
West				1.3200	19.6403	0.7600	0.7000	0.7700	9.5580 (80)				
Solar gains	504.5106	853.8404	1163.4491	1449.6269	1642.7272	1642.3324	1578.3747	1430.4960	1260.8716	941.4245	603.0415	432.6916	(83)
Total gains	1618.2762	1963.1748	2234.6265	2452.6411	2575.5934	2513.4186	2414.0119	2271.8972	2139.3640	1883.8545	1620.6671	1514.9155	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.9428	30.0111	30.0783	30.3981	30.4587	30.7440	30.7440	30.7974	30.6335	30.4587	30.3364	30.2096
alpha	2.9962	3.0007	3.0052	3.0265	3.0306	3.0496	3.0496	3.0532	3.0422	3.0306	3.0224	3.0140
util living area												
	0.9841	0.9713	0.9490	0.9047	0.8240	0.6940	0.5532	0.5972	0.7853	0.9253	0.9743	0.9869 (86)
Living	19.0358	19.2717	19.6163	20.0448	20.4306	20.7121	20.8315	20.8120	20.6042	20.0945	19.4824	18.9948
Non living	17.7098	18.0109	18.4485	18.9908	19.4598	19.7832	19.8971	19.8837	19.6713	19.0617	18.2880	17.6627
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	12	0	0	0	0	0	0	0	0	0	0	0
16 / 9	19	28	8	0	0	0	0	0	0	0	0	31

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MIT	20.3182	20.0212	19.7711	20.0448	20.4306	20.7121	20.8315	20.8120	20.6042	20.0945	19.4824	19.8643 (87)
Th 2	20.0440	20.0460	20.0479	20.0570	20.0587	20.0666	20.0666	20.0681	20.0636	20.0587	20.0553	20.0517 (88)
util rest of house												
	0.9815	0.9665	0.9402	0.8871	0.7887	0.6282	0.4562	0.5023	0.7311	0.9080	0.9692	0.9847 (89)
MIT 2	19.4126	19.1478	18.6791	18.9908	19.4598	19.7832	19.8971	19.8837	19.6713	19.0617	18.2880	18.9972 (90)
Living area fraction									fLA =	Living area /	(4) =	0.0761 (91)
MIT	19.4814	19.2142	18.7621	19.0710	19.5336	19.8539	19.9681	19.9543	19.7422	19.1403	18.3789	19.0632 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4814	19.2142	18.7621	19.0710	19.5336	19.8539	19.9681	19.9543	19.7422	19.1403	18.3789	19.0632 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9796	0.9615	0.9251	0.8642	0.7656	0.6113	0.4451	0.4895	0.7092	0.8861	0.9567	0.9819	(94)
Useful gains	1585.3383	1887.6797	2067.2247	2119.6316	1971.8350	1536.4593	1074.5361	1112.1593	1517.3128	1669.2344	1550.4141	1487.4357	(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													
	5268.2236	4955.9741	4235.9986	3476.6463	2672.3589	1775.6710	1138.3448	1199.1708	1913.8048	2913.4235	3863.1867	5112.2429	(97)
Space heating kWh													
	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565	(98a)
Space heating requirement - total per year (kWh/year)												13201.4980	
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													
	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13201.4980	
Space heating per m2											(98c) / (4) =	39.8452	(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 %)													299.1253 (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													
	2740.0666	2061.8938	1613.5678	977.0506	521.1897	0.0000	0.0000	0.0000	0.0000	925.6767	1665.1963	2696.8565	(98)
Space heating efficiency (main heating system 1)													
	299.1253	299.1253	299.1253	299.1253	299.1253	0.0000	0.0000	0.0000	0.0000	299.1253	299.1253	299.1253	(210)
Space heating fuel (main heating system)													
	916.0263	689.3077	539.4287	326.6359	174.2379	0.0000	0.0000	0.0000	0.0000	309.4612	556.6885	901.5809	(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													
	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(64)
Efficiency of water heater (217)m													
	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	160.8142	(216)
Fuel for water heating, kWh/month													
	220.2622	194.8173	206.6474	180.4888	174.2371	156.1766	153.3463	159.7723	161.9348	181.5952	194.4064	217.6626	(219)
Space cooling fuel requirement (221)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting													
	67.5498	54.1910	48.7930	35.7478	27.6126	22.5598	25.1892	32.7419	42.5284	55.7996	63.0255	69.4273	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m													
	-42.3982	-65.7868	-102.7095	-123.9706	-138.5244	-123.7738	-122.0405	-111.6485	-94.1090	-77.0735	-48.0270	-35.9354	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													4413.3671 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													160.8142
Water heating fuel used													2201.3470 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													545.1659 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1085.9972 (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													6073.8827 (238)

10a. Fuel costs - using Table 12 prices

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	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4413.3671	16.4900	727.7642 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2201.3470	16.4900	363.0021 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	545.1659	16.4900	89.8979 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1085.9972	16.4900	-179.0809
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-179.0809 (252)
Total energy cost			1001.5833 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9581 (257)
SAP value		84.4684
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4413.3671	0.1552	684.9468 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2201.3470	0.1410	310.4442 (264)
Space and water heating			995.3911 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	545.1659	0.1443	78.6843 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1085.9972	0.1336	-145.1412
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-145.1412 (269)
Total CO2, kg/year			928.9342 (272)
CO2 emissions per m2			2.8000 (273)
EI value			96.6923
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

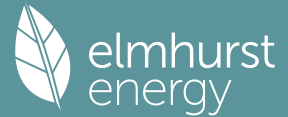
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	119.8200 (1b)	x 2.4500 (2b)	= 293.5590 (1b) - (3b)
First floor	150.4800 (1c)	x 3.0000 (2c)	= 451.4400 (1c) - (3c)
Second floor	61.0200 (1d)	x 3.0000 (2d)	= 183.0600 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	331.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	928.0590 (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	8 * 10 = 80.0000 (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) =	80.0000 / (5) = 0.0862 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3362 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2858 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.9000	3.5000	3.6000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.8750	0.9000	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Adj infilt rate	0.2929	0.2715	0.2786	0.2500	0.2572	0.2286	0.2358	0.2215	0.2215	0.2429	0.2358	0.2643 (22b)

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Effective ac 0.5429 0.5369 0.5388 0.5313 0.5331 0.5261 0.5278 0.5245 0.5245 0.5295 0.5278 0.5349 (25)

3. Heat losses and heat loss parameter

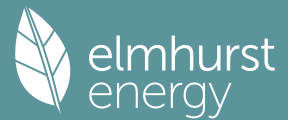
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
Entrance Door			2.1000	1.4000	2.9400			(26a)					
Windows			44.8700	1.3258	59.4867			(27)					
House to Garage Door			1.8900	1.4000	2.6460			(26)					
Ground Floor			119.8200	0.1200	14.3784	110.0000	13180.2000	(28a)					
Above Garage			30.9600	0.1800	5.5728	20.0000	619.2000	(28b)					
Cavity Wall	243.9300	42.5000	201.4300	0.1700	34.2431	60.0000	12085.8000	(29a)					
Stud / Timber Walls	109.6800	6.3600	103.3200	0.1700	17.5644	9.0000	929.8800	(29a)					
Slope Roof	44.2400		44.2400	0.1400	6.1936	9.0000	398.1600	(30)					
Flat Ceilings	36.9200		36.9200	0.1400	5.1688	9.0000	332.2800	(30)					
Between 1st & 2nd Floors	89.4600		89.4600	0.1400	12.5244	9.0000	805.1400	(30)					
Dormer Roofs	9.0000		9.0000	0.1400	1.2600	9.0000	81.0000	(30)					
Total net area of external elements Aum(A, m2)			684.0100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	161.9782			(33)					
Main dwelling													
Internal Walls			454.6800			9.0000	4092.1200	(32c)					
First Floor			119.8200			18.0000	2156.7600	(32d)					
Second Floor			61.0200			18.0000	1098.3600	(32d)					
Ground Floor Ceiling			119.8200			9.0000	1078.3800	(32e)					
First Floor Ceiling			61.0200			9.0000	549.1800	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37406.4600	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							112.9013	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				36.7000	0.0380		1.3946						
E4 Jamb				78.0000	0.0160		1.2480						
E16 Corner (normal)				73.5000	0.0390		2.8665						
E10 Eaves (insulation at ceiling level)				68.9000	0.0610		4.2029						
E11 Eaves (insulation at rafter level)				42.6000	0.0100		0.4260						
E17 Corner (inverted - internal area greater than external area)				46.9000	-0.0910		-4.2679						
E14 Flat roof				19.0000	0.1600		3.0400						
E3 Sill				34.8000	0.0210		0.7308						
E5 Ground floor (normal)				47.4000	0.0370		1.7538						
E6 Intermediate floor within a dwelling				61.8300	0.0030		0.1855						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.5802 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	173.5584	(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	166.2682	164.4158	165.0176	162.7042	163.2591	161.1332	161.6412	160.6408	160.6408	162.1649	161.6412	163.8296	(38)
Average = Sum(39)m / 12 =	339.8266	337.9743	338.5761	336.2626	336.8175	334.6916	335.1996	334.1992	334.1992	335.7233	335.1996	337.3881	(39)
												336.3381	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0257	1.0201	1.0219	1.0149	1.0166	1.0102	1.0117	1.0087	1.0087	1.0133	1.0117	1.0183	(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													3.1726 (42)
Hot water usage for mixer showers													
Hot water usage for baths	106.4453	104.8456	102.5146	98.0546	94.7632	91.0927	89.0064	91.3198	93.8557	97.7967	102.3525	106.0375	(42a)
Hot water usage for other uses	33.4141	32.9179	32.2190	30.9305	29.9657	28.8959	28.3180	29.0120	29.7675	30.9123	32.2273	33.3011	(42b)
Average daily hot water use (litres/day)	47.1211	45.4076	43.6941	41.9806	40.2671	38.5536	38.5536	40.2671	41.9806	43.6941	45.4076	47.1211	(42c)
												171.9565	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	186.9805	183.1710	178.4277	170.9657	164.9960	158.5422	155.8781	160.5989	165.6038	172.4031	179.9874	186.4597	(44)
Energy content (annual)	296.1313	260.8331	274.2367	234.0435	222.1164	194.9462	188.5210	198.8549	204.2061	233.9493	256.4250	291.9508	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss (or HIU loss):	44.4197	39.1250	41.1355	35.1065	33.3175	29.2419	28.2781	29.8282	30.6309	35.0924	38.4638	43.7926	(46)
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0800 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1232 (55)
Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(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	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(64)
												3540.0784	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	144.9289	128.6957	137.6490	122.7859	120.3190	109.7860	109.1485	112.5845	112.8649	124.2534	130.2277	143.5389	(65)

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

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588	190.3588 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	77.1739	68.5451	55.7447	42.2023	31.5467	26.6331	28.7780	37.4067	50.2072	63.7495	74.4051	79.3188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	721.1333	728.6164	709.7592	669.6145	618.9390	571.3112	539.4929	532.0098	550.8670	591.0117	641.6872	689.3150 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085	57.2085 (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)												
	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058	-126.9058 (71)
Water heating gains (Table 5)												
	194.7970	191.5114	185.0121	170.5359	161.7191	152.4806	146.7050	151.3233	156.7568	167.0073	180.8718	192.9286 (72)
Total internal gains												
	1113.7656	1109.3344	1071.1774	1003.0142	932.8662	871.0862	835.6373	841.4012	878.4924	942.4300	1017.6256	1082.2239 (73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access		Gains	
				m2	Table 6a		Specific data	Specific data		factor		W	
					W/m2		or Table 6b	or Table 6c		Table 6d			
North				17.2200	12.7500		0.7600	0.7000		0.7700		80.9445 (74)	
East				2.6400	23.7835		0.7600	0.7000		0.7700		23.1486 (76)	
South				23.6900	54.0600		0.7600	0.7000		0.7700		472.1566 (78)	
West				1.3200	23.7835		0.7600	0.7000		0.7700		11.5743 (80)	
Solar gains		587.8240	884.5691	1180.5625	1505.6161	1674.9960	1769.1663	1696.9972	1568.4592	1367.7665	1029.9327	692.1122	507.1518 (83)
Total gains		1701.5896	1993.9035	2251.7400	2508.6303	2607.8623	2640.2525	2532.6344	2409.8604	2246.2589	1972.3626	1709.7378	1589.3756 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.5764	30.7440	30.6894	30.9005	30.8496	31.0455	30.9985	31.0913	31.0913	30.9501	30.9985	30.7974
alpha	3.0384	3.0496	3.0460	3.0600	3.0566	3.0697	3.0666	3.0728	3.0728	3.0633	3.0666	3.0532
util living area												
	0.9803	0.9678	0.9428	0.8891	0.7915	0.6292	0.4706	0.5103	0.7476	0.9066	0.9679	0.9838 (86)
Living												
	19.1868	19.3899	19.7299	20.1516	20.5269	20.7743	20.8631	20.8520	20.6637	20.2117	19.6131	19.1389
Non living												
	17.9146	18.1754	18.6040	19.1324	19.5801	19.8511	19.9270	19.9222	19.7447	19.2154	18.4664	17.8579
24 / 16												
	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9												
	11	0	0	0	0	0	0	0	0	0	0	0
16 / 9												
	20	28	5	0	0	0	0	0	0	0	0	31
MIT												
	20.3374	20.0881	19.8187	20.1516	20.5269	20.7743	20.8631	20.8520	20.6637	20.2117	19.6131	19.9459 (87)
Th 2												
	20.0620	20.0666	20.0651	20.0709	20.0695	20.0749	20.0736	20.0761	20.0761	20.0723	20.0736	20.0681 (88)
util rest of house												
	0.9770	0.9625	0.9328	0.8687	0.7499	0.5552	0.3679	0.4082	0.6875	0.8851	0.9617	0.9811 (89)
MIT 2												
	19.4505	19.2319	18.7356	19.1324	19.5801	19.8511	19.9270	19.9222	19.7447	19.2154	18.4664	19.0926 (90)
Living area fraction												
	19.5180	19.2970	18.8180	19.2099	19.6522	19.9213	19.9982	19.9930	19.8146	19.2912	18.5536	19.1575 (92)
Temperature adjustment												
	19.5180	19.2970	18.8180	19.2099	19.6522	19.9213	19.9982	19.9930	19.8146	19.2912	18.5536	19.1575 (93)
adjusted MIT												
	19.5180	19.2970	18.8180	19.2099	19.6522	19.9213	19.9982	19.9930	19.8146	19.2912	18.5536	19.1575 (93)

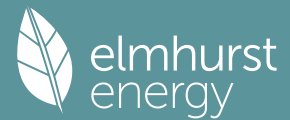
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9747	0.9572	0.9159	0.8456	0.7283	0.5418	0.3591	0.3983	0.6679	0.8621	0.9475	0.9778 (94)
Useful gains	1658.6228	1908.5745	2062.3476	2121.1959	1899.3286	1430.4176	909.3634	959.8746	1500.2847	1700.4058	1619.9357	1554.0776 (95)
Ext temp.	4.8000	5.3000	7.0000	9.4000	12.4000	15.2000	17.2000	17.0000	14.4000	11.1000	7.5000	4.7000 (96)
Heat loss rate W												
	5001.5531	4730.6240	4001.2921	3298.7078	2442.6520	1580.1958	937.9455	1000.2423	1809.5618	2749.9755	3705.1539	4877.7803 (97)
Space heating kWh												
	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98a)
Space heating requirement - total per year (kWh/year)												
												11833.2452
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												
	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												11833.2452
Space heating per m2												
										(98c) / (4) =		35.7155 (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 %)												297.7775 (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	2487.1402	1896.4173	1442.5747	847.8085	404.2326	0.0000	0.0000	0.0000	0.0000	780.8799	1501.3571	2472.8348 (98)
Space heating efficiency (main heating system 1)	297.7775	297.7775	297.7775	297.7775	297.7775	0.0000	0.0000	0.0000	0.0000	297.7775	297.7775	297.7775 (210)
Space heating fuel (main heating system)	835.2345	636.8572	484.4472	284.7121	135.7499	0.0000	0.0000	0.0000	0.0000	262.2361	504.1876	830.4304 (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)

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Water heating													
Water heating requirement	354.2129	313.2939	332.3183	290.2515	280.1980	251.1542	246.6026	256.9365	260.4141	292.0309	312.6330	350.0324	(64)
Efficiency of water heater												160.7959	(216)
(217)m	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	160.7959	(217)
Fuel for water heating, kWh/month	220.2873	194.8395											
Lighting	67.5498	54.1910	206.6709	180.5093	174.2570	156.1944	153.3638	159.7905	161.9532	181.6159	194.4285	217.6874	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	67.5498	54.1910	48.7930	35.7478	27.6126	22.5598	25.1892	32.7419	42.5284	55.7996	63.0255	69.4273	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.5388	-68.9526	-105.0860	-127.9615	-139.5723	-130.6383	-128.7399	-120.0346	-101.3231	-83.9253	-55.1265	-42.2799	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3973.8549	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.7959	
Water heating fuel used												2201.5979	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												545.1659	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1153.1788	(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												5567.4399	(238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3973.8549	28.4300	1129.7670	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2201.5979	28.4300	625.9143	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	545.1659	28.4300	154.9907	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1153.1788	28.4300	-327.8487	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-327.8487	(252)
Total energy cost			1582.8232	(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	3973.8549	0.1555	617.9502	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2201.5979	0.1410	310.4796	(264)
Space and water heating			928.4298	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	545.1659	0.1443	78.6843	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1153.1788	0.1338	-154.3090	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-154.3090	(269)
Total CO2, kg/year			852.8051	(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	3973.8549	1.5757	6261.5796	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2201.5979	1.5215	3349.6529	(278)
Space and water heating			9611.2326	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	545.1659	1.5338	836.1936	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1153.1788	1.4945	-1723.4294	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1723.4294	(283)
Total Primary energy kWh/year			8723.9968	(286)

