

Full SAP Calculation Printout



Property Reference	24 Ambleside Drive Planning		Issued on Date	07/11/2023	
Assessment Reference	Proposed	Prop Type Ref			
Property	24, Ambleside Drive, Oxford, OX3 0AQ				
SAP Rating	87 B	DER	2.24	TER	7.75
Environmental	98 A	% DER < TER	71.10		
CO ₂ Emissions (t/year)	0.43	DFEE	40.02	TFEE	40.14
Compliance Check	See BREL	% DFEE < TFEE	0.31		
% DPER < TPER	38.33	DPER	25.38	TPER	41.15
Assessor Details	Mr. Peter Yearsley			Assessor ID	R301-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	580.2000 (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	5 * 10 = 50.0000 (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) =	50.0000 / (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	0.3643	0.3572	0.3500	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	0.5368	0.5368	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
HGD			1.9100	1.2000	2.2920		(26a)
Windows (Uw = 1.20)			27.0800	1.1450	31.0076		(27)
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10.3397		(27)
Heatloss Floor 1			125.0000	0.1300	16.2500	110.0000	13750.0000 (28a)
Brick Facing	127.3500	22.2700	105.0800	0.1900	19.9652	60.0000	6304.8000 (29a)
Rendered	102.0300	13.8800	88.1500	0.1900	16.7485	60.0000	5289.0000 (29a)
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0.3260	9.0000	14.6700 (29a)
RIR Stud	7.6900		7.6900	0.2000	1.5380	9.0000	69.2100 (29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645	9.0000	872.5500 (30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180	9.0000	34.2000 (30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200	9.0000	18.0000 (30)
Slope Roof	2.9000		2.9000	0.1100	0.3190	9.0000	26.1000 (30)
Total net area of external elements Aum (A, m ²)			491.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	112.2885		(33)
Internal Wall 1			381.7200			9.0000	3435.4800 (32c)
Internal Floor 1			102.8000			18.0000	1850.4000 (32d)
Internal Ceiling 1			102.8000			9.0000	925.2000 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ}/\text{m}^2\text{K}$ (28)...(30) + (32) + (32a)...(32e) = 32769.6100 (34)
 143.8525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	25.9100	0.3950	10.2345
E3 Sill	20.7000	0.0220	0.4554
E4 Jamb	59.8000	0.0170	1.0166
E5 Ground floor (normal)	52.4000	0.0840	4.4016
E6 Intermediate floor within a dwelling	42.4000	0.0010	0.0424
E16 Corner (normal)	43.0500	0.0460	1.9803
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690
E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0880	-1.9826
R6 Flat ceiling	2.3000	0.1200	0.2760
R7 Flat ceiling (inverted)	3.0000	0.1200	0.3600
R8 Roof to wall (rafter)	2.3000	0.1200	0.2760
R9 Roof to wall (flat ceiling)	3.0000	0.3200	0.9600
E13 Gable (insulation at rafter level)	1.4000	0.0500	0.0700
E14 Flat roof	12.8000	0.1600	2.0480

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.6071 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 134.8956 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	108.4404	107.9469	107.4633	105.1915	104.7664	102.7878	102.7878	102.4214	103.5499	104.7664	105.6263	106.5252
Average = $\text{Sum}(39)\text{m} / 12 =$	243.3360	242.8426	242.3589	240.0871	239.6621	237.6834	237.6834	237.3170	238.4456	239.6621	240.5219	241.4209
	243.3360	242.8426	242.3589	240.0871	239.6621	237.6834	237.6834	237.3170	238.4456	239.6621	240.5219	241.4209

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0682	1.0660	1.0639	1.0539	1.0521	1.0434	1.0434	1.0418	1.0467	1.0521	1.0558	1.0598
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	75.1583	74.0288	72.3830	69.2339	66.9099	64.3183	62.8452	64.4786	66.2691	69.0518	72.2685	74.8704
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429
Average daily hot water use (litres/day)	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473
Energy content (annual)	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785
Distribution loss (46)m = $0.15 \times (45)\text{m}$	36.4291	32.0547	33.6785	28.7518	27.2795	23.9408	23.1784	24.4678	25.1414	28.7986	31.5509	35.9218
Water storage loss:												
Store volume												250.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.7700
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												0.9558
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298
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
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
Total heat required for water heating calculated for each month	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707
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
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
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
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
Output from w/h	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707
12Total per year (kWh/year)												2964.0520
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) m =												0.0000
Heat gains from water heating, kWh/month	123.0650	109.2735	116.9678	104.6820	102.7834	94.0176	93.6926	96.5506	96.6788	106.1506	110.8867	121.9404

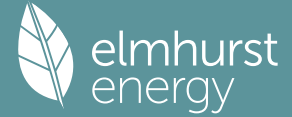
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.1648	231.5753	209.1648	216.1370	209.1648	216.1370	209.1648	209.1648	216.1370	209.1648	216.1370	209.1648
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.7554	400.8725	390.4976	368.4106	340.5298	314.3258	296.8199	292.7028	303.0777	325.1647	353.0455	379.2495
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903
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
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228
Water heating gains (Table 5)	165.4100	162.6093	157.2147	145.3917	138.1497	130.5800	125.9310	129.7724	134.2761	142.6755	154.0093	163.8983
Total internal gains	839.9012	863.6282	825.4482	798.5104	756.4154	729.6138	700.4867	700.2110	722.0619	745.5760	791.7628	820.8837

6. Solar gains

[Jan] Area Solar flux g FF Access Gains

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
North	1.3200	10.6334	0.7600	0.7000	0.7700	5.1748 (74)
East	9.3800	19.6403	0.7600	0.7000	0.7700	67.9196 (76)
South	4.2900	46.7521	0.7600	0.7000	0.7700	73.9440 (78)
West	12.0900	19.6403	0.7600	0.7000	0.7700	87.5424 (80)
East	9.0300	19.6403	0.7600	0.7000	0.7700	65.3853 (76)

Solar gains	299.9660	563.0146	882.5479	1238.9952	1489.7273	1515.5648	1446.5374	1259.3294	1008.8316	655.0239	369.4032	249.8224 (83)
Total gains	1139.8673	1426.6428	1707.9960	2037.5055	2246.1427	2245.1787	2147.0241	1959.5404	1730.8935	1400.5999	1161.1659	1070.7061 (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	37.4078	37.4838	37.5586	37.9140	37.9813	38.2975	38.2975	38.3566	38.1750	37.9813	37.8455	37.7046
alpha	3.4939	3.4989	3.5039	3.5276	3.5321	3.5532	3.5532	3.5571	3.5450	3.5321	3.5230	3.5136
util living area	0.9915	0.9811	0.9573	0.8931	0.7763	0.6115	0.4669	0.5240	0.7598	0.9383	0.9841	0.9932 (86)
Living	19.3177	19.5471	19.8897	20.3205	20.6480	20.8322	20.8896	20.8779	20.7326	20.2695	19.7126	19.2823
Non living	18.0319	18.3251	18.7593	19.2970	19.6796	19.8768	19.9243	19.9185	19.7844	19.2470	18.5440	17.9916
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1394	19.5471	19.8897	20.3205	20.6480	20.8322	20.8896	20.8779	20.7326	20.2695	19.7126	19.5225 (87)
Th 2	20.0269	20.0287	20.0304	20.0386	20.0402	20.0473	20.0473	20.0487	20.0446	20.0402	20.0371	20.0338 (88)
util rest of house	0.9898	0.9773	0.9485	0.8712	0.7319	0.5391	0.3738	0.4280	0.6965	0.9210	0.9803	0.9917 (89)
MIT 2	19.2315	18.3251	18.7593	19.2970	19.6796	19.8768	19.9243	19.9185	19.7844	19.2470	18.5440	18.3596 (90)
Living area fraction											fLA = Living area / (4) =	0.1708 (91)
MIT	19.3866	18.5338	18.9523	19.4717	19.8449	20.0399	20.0891	20.0823	19.9463	19.4216	18.7436	18.5582 (92)
Temperature adjustment											0.0000	
adjusted MIT	19.3866	18.5338	18.9523	19.4717	19.8449	20.0399	20.0891	20.0823	19.9463	19.4216	18.7436	18.5582 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9884	0.9694	0.9360	0.8558	0.7218	0.5385	0.3781	0.4316	0.6891	0.9067	0.9732	0.9888 (94)
Useful gains	1126.5938	1382.9753	1598.7046	1743.7088	1621.2009	1208.9925	811.7508	845.7802	1192.8415	1269.9933	1130.0138	1058.7190 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3671.1053	3310.8666	3017.9261	2538.1408	1952.0347	1292.9844	829.3127	873.8724	1394.0284	2114.2049	2800.5308	3466.3696 (97)
Space heating	1893.1166	1295.5429	1055.9008	571.9910	246.1404	0.0000	0.0000	0.0000	0.0000	628.0934	1202.7722	1791.2920 (98a)
Space heating requirement - total per year (kWh/year)												8684.8493
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	1893.1166	1295.5429	1055.9008	571.9910	246.1404	0.0000	0.0000	0.0000	0.0000	628.0934	1202.7722	1791.2920 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8684.8493
Space heating per m2											(98c) / (4) =	38.1249 (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 %) 329.7466 (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	1893.1166	1295.5429	1055.9008	571.9910	246.1404	0.0000	0.0000	0.0000	0.0000	628.0934	1202.7722	1791.2920 (98)
Space heating efficiency (main heating system 1)	329.7466	329.7466	329.7466	329.7466	329.7466	0.0000	0.0000	0.0000	0.0000	329.7466	329.7466	329.7466 (210)
Space heating fuel (main heating system)	574.1125	392.8904	320.2158	173.4638	74.6453	0.0000	0.0000	0.0000	0.0000	190.4776	364.7565	543.2328 (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 295.7531 261.4716 277.4155 242.8649 234.7558 210.7915 207.4151 216.0106 218.7951 244.8826 261.5254 292.3707 (64)

Efficiency of water heater (217)m 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 160.3435 (216)

Fuel for water heating, kWh/month 184.4497 163.0697 173.0133 151.4654 146.4081 131.4625 129.3568 134.7174 136.4540 152.7238 163.1033 182.3403 (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 53.8990 43.2390 38.9319 28.5232 22.0321 18.0004 20.0985 26.1247 33.9334 44.5225 50.2881 55.3960 (232)

Electricity generated by PVs (Appendix M) (negative quantity) (233a)m -45.4457 -66.9834 -99.1676 -113.2123 -122.4970 -111.2853 -110.1199 -102.6944 -89.7731 -76.9239 -50.7440 -38.9037 (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 -10.5177 -23.2244 -46.9242 -73.1124 -100.5590 -105.3592 -104.7637 -89.5995 -67.4793 -36.2571 -14.9880 -8.3777 (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)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											2633.7946	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											160.3435	
Water heating fuel used											1848.5641	(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)											434.9880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1708.9128	(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											3208.4340	(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	2633.7946	0.1555	409.6244 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1848.5641	0.1410	260.6032 (264)
Space and water heating			670.2277 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	434.9880	0.1443	62.7822 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1027.7506	0.1344	-138.1536
PV Unit electricity exported	-681.1622	0.1242	-84.5928
Total			-222.7464 (269)
Total CO2, kg/year			510.2635 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.2400 (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	2633.7946	1.5758	4150.2124 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1848.5641	1.5213	2812.1873 (278)
Space and water heating			6962.3998 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	434.9880	1.5338	667.1991 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1027.7506	1.4968	-1538.3455
PV Unit electricity exported	-681.1622	0.4557	-310.4395
Total			-1848.7850 (283)
Total Primary energy kWh/year			5780.8140 (286)
Dwelling Primary energy Rate (DPER)			25.3800 (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)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	580.2000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0689 (8)

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Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3189 (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) =	0.2711 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate												
Effective ac	0.3457	0.3389	0.3321	0.2982	0.2914	0.2575	0.2575	0.2508	0.2711	0.2914	0.3050	0.3185 (22b)
	0.5597	0.5574	0.5551	0.5445	0.5425	0.5332	0.5332	0.5314	0.5367	0.5425	0.5465	0.5507 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			1.9100	1.0000	1.9100		(26a)
TER Opening Type (Uw = 1.20)			36.1100	1.1450	41.3473		(27)
Heatloss Floor 1			125.0000	0.1300	16.2500		(28a)
Brick Facing	127.3500	22.2700	105.0800	0.1800	18.9144		(29a)
Rendered	102.0300	13.8800	88.1500	0.1800	15.8670		(29a)
Dormer Walls	3.5000	1.8700	1.6300	0.1800	0.2934		(29a)
RIR Stud	7.6900		7.6900	0.1800	1.3842		(29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645		(30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000		(30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180		(30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200		(30)
Slope Roof	2.9000		2.9000	0.1100	0.3190		(30)
Total net area of external elements Aum(A, m2)			491.2200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 109.7878		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 143.8525 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	25.9100	0.0500	1.2955
E1 Steel lintel with perforated steel base plate	20.7000	0.0500	1.0350
E3 Sill	59.8000	0.0500	2.9900
E4 Jamb	52.4000	0.1600	8.3840
E5 Ground floor (normal)	42.4000	0.0000	0.0000
E6 Intermediate floor within a dwelling	43.0500	0.0900	3.8745
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690
E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0900	-2.0277
R6 Flat ceiling	2.3000	0.0600	0.1380
R7 Flat ceiling (inverted)	3.0000	0.0400	0.1200
R8 Roof to wall (rafter)	2.3000	0.0600	0.1380
R9 Roof to wall (flat ceiling)	3.0000	0.0400	0.1200
E13 Gable (insulation at rafter level)	1.4000	0.0800	0.1120
E14 Flat roof	12.8000	0.0800	1.0240
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.6723 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 129.4601 (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	107.1708	106.7267	106.2913	104.2465	103.8639	102.0829	102.0829	101.7531	102.7689	103.8639	104.6379	105.4470 (38)
Average = Sum(39)m / 12 =	236.6309	236.1868	235.7514	233.7066	233.3240	231.5431	231.5431	231.2133	232.2291	233.3240	234.0980	234.9071 (39)
												233.7048

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0388	1.0368	1.0349	1.0259	1.0242	1.0164	1.0164	1.0150	1.0194	1.0242	1.0276	1.0312 (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													3.0381 (42)	
Hot water usage for mixer showers														74.8704 (42a)
Hot water usage for baths														32.3341 (42b)
Hot water usage for other uses														45.7429 (42c)
Average daily hot water use (litres/day)														140.9584 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473 (44)		
Energy content (annual)	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785 (45)		
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2341.2890	
Water storage 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														
If cylinder contains dedicated solar storage														
Primary 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)		
Combi 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 (57)		
Total heat required for water heating calculated for each month														
WWHRS	297.7677	263.2913	279.4301	244.8145	236.7704	212.7411	209.4297	218.0252	220.7447	246.8972	263.4750	294.3853 (62)		
PV diverter	-34.3592	-30.3876	-31.8201	-26.3483	-24.5557	-21.0125	-19.6959	-20.9446	-21.7403	-25.6295	-29.0351	-33.7230 (63a)		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)		
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)		

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Output from w/h	263.4085	232.9037	247.6100	218.4662	212.2147	191.7286	189.7339	197.0807	199.0043	221.2677	234.4400	260.6623 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64) m =											2668.5204 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) m =											0.0000 (64a)
Heat gains from water heating, kWh/month	124.6767	110.7292	118.5794	106.2417	104.3951	95.5773	95.3043	98.1623	98.2385	107.7622	112.4463	123.5520 (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
	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	209.1648	231.5753	209.1648	216.1370	209.1648	216.1370	209.1648	209.1648	216.1370	209.1648	216.1370	209.1648 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	396.7554	400.8725	390.4976	368.4106	340.5298	314.3258	296.8199	292.7028	303.0777	325.1647	353.0455	379.2495 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228 (71)
Water heating gains (Table 5)												
	167.5762	164.7756	159.3810	147.5579	140.3160	132.7463	128.0972	131.9386	136.4424	144.8417	156.1755	166.0646 (72)
Total internal gains	845.0675	868.7944	830.6144	803.6766	761.5816	731.7801	702.6529	702.3773	724.2281	750.7422	796.9290	826.0499 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)						
East	18.4100	19.6403	0.6300	0.7000	0.7700	110.5027 (76)						
South	4.2900	46.7521	0.6300	0.7000	0.7700	61.2957 (78)						
West	12.0900	19.6403	0.6300	0.7000	0.7700	72.5680 (80)						
Solar gains	248.6561	466.7094	731.5857	1027.0618	1234.9055	1256.3235	1199.1034	1043.9178	836.2683	542.9803	306.2158	207.0896 (83)
Total gains	1093.7235	1335.5039	1562.2001	1830.7384	1996.4871	1988.1036	1901.7563	1746.2950	1560.4964	1293.7226	1103.1448	1033.1396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	38.4678	38.5401	38.6113	38.9491	39.0130	39.3131	39.3131	39.3692	39.1969	39.0130	38.8840	38.7501
alpha	3.5645	3.5693	3.5741	3.5966	3.6009	3.6209	3.6209	3.6246	3.6131	3.6009	3.5923	3.5833
util living area	0.9926	0.9844	0.9660	0.9146	0.8140	0.6572	0.5082	0.5652	0.7935	0.9487	0.9863	0.9939 (86)
MIT	18.9060	19.1813	19.6035	20.1542	20.6004	20.8711	20.9616	20.9436	20.7325	20.1202	19.4126	18.8624 (87)
Th 2	20.0512	20.0528	20.0543	20.0618	20.0632	20.0697	20.0697	20.0709	20.0672	20.0632	20.0604	20.0574 (88)
util rest of house	0.9910	0.9812	0.9588	0.8962	0.7736	0.5854	0.4115	0.4671	0.7345	0.9339	0.9830	0.9927 (89)
MIT 2	17.5730	17.9249	18.4611	19.1510	19.6802	19.9729	20.0500	20.0396	19.8414	19.1221	18.2269	17.5212 (90)
Living area fraction									fLA = Living area / (4) =			0.1708 (91)
MIT	17.8007	18.1394	18.6562	19.3223	19.8373	20.1263	20.2056	20.1940	19.9935	19.2925	18.4293	17.7503 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8007	18.1394	18.6562	19.3223	19.8373	20.1263	20.2056	20.1940	19.9935	19.2925	18.4293	17.7503 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9855	0.9719	0.9445	0.8783	0.7626	0.5901	0.4262	0.4808	0.7292	0.9179	0.9745	0.9880 (94)
Useful gains	1077.8448	1298.0129	1475.5515	1607.9367	1522.4628	1173.2087	810.5515	839.6709	1137.9333	1187.4920	1075.0680	1020.6909 (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	3194.6722	3126.9767	2865.8436	2435.7665	1898.6338	1279.5696	834.8597	877.2229	1368.6519	2028.1710	2652.1753	3183.0509 (97)
Space heating kWh	1574.9196	1229.0637	1034.3773	596.0375	279.8712	0.0000	0.0000	0.0000	0.0000	625.4651	1135.5172	1608.7958 (98a)
Space heating requirement - total per year (kWh/year)												8084.0476
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	1574.9196	1229.0637	1034.3773	596.0375	279.8712	0.0000	0.0000	0.0000	0.0000	625.4651	1135.5172	1608.7958 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8084.0476
Space heating per m ²												(98c) / (4) = 35.4875 (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
	1574.9196	1229.0637	1034.3773	596.0375	279.8712	0.0000	0.0000	0.0000	0.0000	625.4651	1135.5172	1608.7958 (98)
Space heating efficiency (main heating system 1)												

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Space heating fuel (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating efficiency (main heating system 2)	1706.3051	1331.5966	1120.6688	645.7611	303.2191	0.0000	0.0000	0.0000	0.0000	677.6437	1230.2462	1743.0074	(211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	263.4085	232.9037	247.6100	218.4662	212.2147	191.7286	189.7339	197.0807	199.0043	221.2677	234.4400	260.6623	(64)
Efficiency of water heater (217)m	87.3878	87.2327	86.9069	86.1926	84.6813	79.8000	79.8000	79.8000	79.8000	86.2578	87.1186	79.8000	(216)
Fuel for water heating, kWh/month	301.4248	266.9913	284.9141	253.4627	250.6040	240.2614	237.7617	246.9683	249.3789	256.5191	269.1044	298.1547	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	43.4603	34.8655	31.3925	22.9995	17.7655	14.5145	16.2063	21.0655	27.3620	35.9004	40.5495	44.6682	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-99.6185	-132.4431	-179.5383	-189.8325	-194.8605	-178.1732	-175.6281	-170.2553	-159.8721	-145.1234	-106.4765	-87.0639	(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)	-83.4061	-171.4375	-333.7605	-491.6712	-641.3075	-641.4934	-634.2329	-541.2172	-402.2010	-242.2112	-110.3181	-66.2961	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												8758.4481	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	(216)
Water heating fuel used												3155.5453	(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)												350.7496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-6178.4382	(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												6172.3048	(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	8758.4481	0.2100	1839.2741 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3155.5453	0.2100	662.6645 (264)
Space and water heating			2501.9386 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	350.7496	0.1443	50.6240 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1818.8855	0.1359	-247.2204
PV Unit electricity exported	-4359.5527	0.1265	-551.3354
Total			-798.5558 (269)
Total CO2, kg/year			1765.9361 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.7500 (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	8758.4481	1.1300	9897.0463 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3155.5453	1.1300	3565.7662 (278)
Space and water heating			13462.8125 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	350.7496	1.5338	537.9915 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1818.8855	1.5024	-2732.7032
PV Unit electricity exported	-4359.5527	0.4642	-2023.8867
Total			-4756.5899 (283)
Total Primary energy kWh/year			9374.3149 (286)
Target Primary Energy Rate (TPER)			41.1500 (287)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 580.2000 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) =	0.0689 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50		5.0000 (17)										
Infiltration rate		0.3189 (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) =	0.2711 (21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3457	0.3389	0.3321	0.2982	0.2914	0.2575	0.2575	0.2508	0.2711	0.2914	0.3050	0.3185 (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	0.5597	0.5574	0.5551	0.5445	0.5425	0.5332	0.5332	0.5314	0.5367	0.5425	0.5465	0.5507 (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					
HGD			1.9100	1.2000	2.2920		(26a)					
Windows (Uw = 1.20)			27.0800	1.1450	31.0076		(27)					
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10.3397		(27)					
Heatloss Floor 1			125.0000	0.1300	16.2500	110.0000	13750.0000 (28a)					
Brick Facing	127.3500	22.2700	105.0800	0.1900	19.9652	60.0000	6304.8000 (29a)					
Rendered	102.0300	13.8800	88.1500	0.1900	16.7485	60.0000	5289.0000 (29a)					
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0.3260	9.0000	14.6700 (29a)					
RIR Stud	7.6900		7.6900	0.2000	1.5380	9.0000	69.2100 (29a)					
Plane Ceiling	96.9500		96.9500	0.1100	10.6645	9.0000	872.5500 (30)					
GF Flat Roof	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)					
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180	9.0000	34.2000 (30)					
Adj To RIR	2.0000		2.0000	0.1100	0.2200	9.0000	18.0000 (30)					
Slope Roof	2.9000		2.9000	0.1100	0.3190	9.0000	26.1000 (30)					
Total net area of external elements Aum(A, m ²)			491.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	112.2885	(33)					
Internal Wall 1			381.7200			9.0000	3435.4800 (32c)					
Internal Floor 1			102.8000			18.0000	1850.4000 (32d)					
Internal Ceiling 1			102.8000			9.0000	925.2000 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							32769.6100 (34)					
List of Thermal Bridges							143.8525 (35)					
K1 Element				Length	Psi-value	Total						
E1 Steel lintel with perforated steel base plate				25.9100	0.3950	10.2345						
E3 Sill				20.7000	0.0220	0.4554						
E4 Jamb				59.8000	0.0170	1.0166						
E5 Ground floor (normal)				52.4000	0.0840	4.4016						
E6 Intermediate floor within a dwelling				42.4000	0.0010	0.0424						
E16 Corner (normal)				43.0500	0.0460	1.9803						
E10 Eaves (insulation at ceiling level)				41.1500	0.0600	2.4690						
E17 Corner (inverted - internal area greater than external area)				22.5300	-0.0880	-1.9826						
R6 Flat ceiling				2.3000	0.1200	0.2760						
R7 Flat ceiling (inverted)				3.0000	0.1200	0.3600						
R8 Roof to wall (rafter)				2.3000	0.1200	0.2760						
R9 Roof to wall (flat ceiling)				3.0000	0.3200	0.9600						
E13 Gable (insulation at rafter level)				1.4000	0.0500	0.0700						
E14 Flat roof				12.8000	0.1600	2.0480						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.6071 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 134.8956 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 107.1708	Feb 106.7267	Mar 106.2913	Apr 104.2465	May 103.8639	Jun 102.0829	Jul 102.0829	Aug 101.7531	Sep 102.7689	Oct 103.8639	Nov 104.6379	Dec 105.4470 (38)
Heat transfer coeff	242.0664	241.6223	241.1869	239.1421	238.7595	236.9786	236.9786	236.6488	237.6646	238.7595	239.5335	240.3426 (39)
Average = Sum(39)m / 12 =												239.1403
HLP	Jan 1.0626	Feb 1.0607	Mar 1.0588	Apr 1.0498	May 1.0481	Jun 1.0403	Jul 1.0403	Aug 1.0388	Sep 1.0433	Oct 1.0481	Nov 1.0515	Dec 1.0551 (40)
HLP (average)												1.0498
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													3.0381 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341	(42b)
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429	(42c)
Average daily hot water use (litres/day)													71.6649 (43)
Daily hot water use	78.1866	76.0414	73.6995	70.7851	68.1849	65.4828	64.9217	67.2588	69.6558	72.4307	75.3709	78.0769	(44)
Energy content (annual)	123.8285	108.2820	113.2734	96.9012	91.7900	80.5187	78.5171	83.2805	85.8926	98.2878	107.3797	122.2496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	105.2542	92.0397	96.2824	82.3660	78.0215	68.4409	66.7396	70.7884	73.0087	83.5446	91.2727	103.9122	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	105.2542	92.0397	96.2824	82.3660	78.0215	68.4409	66.7396	70.7884	73.0087	83.5446	91.2727	103.9122	(64)
12Total per year (kWh/year)													1011.6709 (64)
Electric shower(s)	60.1893	53.6292	58.5610	55.8840	56.9327	54.3082	56.1185	56.9327	55.8840	58.5610	57.4598	60.1893	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													684.6496 (64a)
Heat gains from water heating, kWh/month	41.3609	36.4172	38.7108	34.5625	33.7385	30.6873	30.7145	31.9303	32.2232	35.5264	37.1831	41.0254	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.1648	231.5753	209.1648	216.1370	209.1648	216.1370	209.1648	209.1648	216.1370	209.1648	216.1370	209.1648	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.7554	400.8725	390.4976	368.4106	340.5298	314.3258	296.8199	292.7028	303.0777	325.1647	353.0455	379.2495	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	(71)
Water heating gains (Table 5)	55.5926	54.1923	52.0307	48.0035	45.3475	42.6212	41.2830	42.9170	44.7544	47.7505	51.6432	55.1416	(72)
Total internal gains	730.0838	755.2111	720.2641	701.1221	663.6132	641.6550	615.8387	613.3557	632.5402	650.6511	689.3967	712.1270	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	1.3200	10.6334	0.7600	0.7000	0.7700	5.1748 (74)							
East	9.3800	19.6403	0.7600	0.7000	0.7700	67.9196 (76)							
South	4.2900	46.7521	0.7600	0.7000	0.7700	73.9440 (78)							
West	12.0900	19.6403	0.7600	0.7000	0.7700	87.5424 (80)							
East	9.0300	19.6403	0.7600	0.7000	0.7700	65.3853 (76)							
Solar gains	299.9660	563.0146	882.5479	1238.9952	1489.7273	1515.5648	1446.5374	1259.3294	1008.8316	655.0239	369.4032	249.8224	(83)
Total gains	1030.0499	1318.2257	1602.8120	1940.1173	2153.3404	2157.2199	2062.3761	1872.6851	1641.3718	1305.6749	1058.7999	961.9494	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	37.6040	37.6731	37.7411	38.0638	38.1248	38.4114	38.4114	38.4649	38.3005	38.1248	38.0017	37.8737	
alpha	3.5069	3.5115	3.5161	3.5376	3.5417	3.5608	3.5608	3.5643	3.5534	3.5417	3.5334	3.5249	
util living area	0.9938	0.9851	0.9641	0.9043	0.7916	0.6286	0.4825	0.5429	0.7800	0.9486	0.9880	0.9951	(86)
MIT	18.8092	19.1183	19.5819	20.1703	20.6241	20.8827	20.9653	20.9474	20.7376	20.0931	19.3377	18.7597	(87)
Th 2	20.0315	20.0331	20.0346	20.0420	20.0434	20.0499	20.0499	20.0511	20.0474	20.0434	20.0406	20.0377	(88)
util rest of house	0.9925	0.9820	0.9565	0.8840	0.7485	0.5559	0.3874	0.4451	0.7188	0.9336	0.9851	0.9941	(89)
MIT 2	18.0099	18.3180	18.7769	19.3505	19.7663	19.9825	20.0363	20.0289	19.8769	19.2888	18.5434	17.9649	(90)
Living area fraction													0.1708 (91)
MIT	18.1464	18.4547	18.9143	19.4905	19.9128	20.1362	20.1950	20.1857	20.0239	19.4261	18.6790	18.1006	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1464	18.4547	18.9143	19.4905	19.9128	20.1362	20.1950	20.1857	20.0239	19.4261	18.6790	18.1006	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9751	0.9451	0.8701	0.7420	0.5629	0.4025	0.4597	0.7171	0.9212	0.9792	0.9911 (94)
Useful gains	1018.6071	1285.4423	1514.8222	1688.1128	1597.7035	1214.3618	830.0733	860.9285	1176.9662	1202.8213	1036.7320	953.4132 (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	3351.7371	3275.1157	2994.1774	2532.6393	1960.8905	1311.9601	851.9281	895.8844	1407.8910	2107.3174	2773.5641	3340.9095 (97)
Space heating kWh	1735.8488	1337.0605	1100.6402	608.0591	270.2112	0.0000	0.0000	0.0000	0.0000	672.9451	1250.5191	1776.2973 (98a)
Space heating requirement - total per year (kWh/year)												8751.5813
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	1735.8488	1337.0605	1100.6402	608.0591	270.2112	0.0000	0.0000	0.0000	0.0000	672.9451	1250.5191	1776.2973 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8751.5813
Space heating per m2										(98c) / (4) =		38.4178 (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	2227.5986	1753.6415	1798.5306	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8117	0.8740	0.8362	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1808.0391	1532.7253	1503.8511	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2418.5326	2311.8586	2094.4625	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	439.5553	579.6752	439.4149	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	109.8888	144.9188	109.8537	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												364.6614 (107)
Energy for space heating												38.4178 (99)
Energy for space cooling												1.6008 (108)
Total												40.0186 (109)
Fabric Energy Efficiency (DFEE)												40.0 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	580.2000 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0689 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3189 (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) =	0.2711 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3457	0.3389	0.3321	0.2982	0.2914	0.2575	0.2575	0.2508	0.2711	0.2914	0.3050	0.3185 (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	0.5597	0.5574	0.5551	0.5445	0.5425	0.5332	0.5332	0.5314	0.5367	0.5425	0.5465	0.5507 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Semi-glazed door			1.9100	1.0000	1.9100			(26a)
TER Opening Type (Uw = 1.20)			36.1100	1.1450	41.3473			(27)
Heatloss Floor 1			125.0000	0.1300	16.2500			(28a)
Brick Facing	127.3500	22.2700	105.0800	0.1800	18.9144			(29a)
Rendered	102.0300	13.8800	88.1500	0.1800	15.8670			(29a)
Dormer Walls	3.5000	1.8700	1.6300	0.1800	0.2934			(29a)
RIR Stud	7.6900		7.6900	0.1800	1.3842			(29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645			(30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000			(30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180			(30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200			(30)
Slope Roof	2.9000		2.9000	0.1100	0.3190			(30)
Total net area of external elements Aum(A, m ²)			491.2200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =	109.7878		(33)

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

List of Thermal Bridges 143.8525 (35)

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	25.9100	0.0500	1.2955	
E3 Sill	20.7000	0.0500	1.0350	
E4 Jamb	59.8000	0.0500	2.9900	
E5 Ground floor (normal)	52.4000	0.1600	8.3840	
E6 Intermediate floor within a dwelling	42.4000	0.0000	0.0000	
E16 Corner (normal)	43.0500	0.0900	3.8745	
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690	
E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0900	-2.0277	
R6 Flat ceiling	2.3000	0.0600	0.1380	
R7 Flat ceiling (inverted)	3.0000	0.0400	0.1200	
R8 Roof to wall (rafter)	2.3000	0.0600	0.1380	
R9 Roof to wall (flat ceiling)	3.0000	0.0400	0.1200	
E13 Gable (insulation at rafter level)	1.4000	0.0800	0.1120	
E14 Flat roof	12.8000	0.0800	1.0240	

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

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 129.4601 (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	107.1708	106.7267	106.2913	104.2465	103.8639	102.0829	102.0829	101.7531	102.7689	103.8639	104.6379	105.4470	(38)
Average = Sum(39)m / 12 =	236.6309	236.1868	235.7514	233.7066	233.3240	231.5431	231.5431	231.2133	232.2291	233.3240	234.0980	234.9071	(39)
													233.7048

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0388	1.0368	1.0349	1.0259	1.0242	1.0164	1.0164	1.0150	1.0194	1.0242	1.0276	1.0312	(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													3.0381 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341	(42b)
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429	(42c)
Average daily hot water use (litres/day)													71.6649 (43)
Daily hot water use	78.1866	76.0414	73.6995	70.7851	68.1849	65.4828	64.9217	67.2588	69.6558	72.4307	75.3709	78.0769	(44)
Energy conte	123.8285	108.2820	113.2734	96.9012	91.7900	80.5187	78.5171	83.2805	85.8926	98.2878	107.3797	122.2496	(45)
Energy content (annual)													Total = Sum(45)m = 1190.2011
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	105.2542	92.0397	96.2824	82.3660	78.0215	68.4409	66.7396	70.7884	73.0087	83.5446	91.2727	103.9122	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	105.2542	92.0397	96.2824	82.3660	78.0215	68.4409	66.7396	70.7884	73.0087	83.5446	91.2727	103.9122	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1011.6709 (64)
Electric shower(s)	60.1893	53.6292	58.5610	55.8840	56.9327	54.3082	56.1185	56.9327	55.8840	58.5610	57.4598	60.1893	(64a)
Heat gains from water heating, kWh/month	41.3609	36.4172	38.7108	34.5625	33.7385	30.6873	30.7145	31.9303	32.2232	35.5264	37.1831	41.0254	(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	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	151.9035	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.1648	231.5753	209.1648	216.1370	209.1648	216.1370	209.1648	209.1648	216.1370	209.1648	216.1370	209.1648	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.7554	400.8725	390.4976	368.4106	340.5298	314.3258	296.8199	292.7028	303.0777	325.1647	353.0455	379.2495	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903	38.1903 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228 (71)
Water heating gains (Table 5)	55.5926	54.1923	52.0307	48.0035	45.3475	42.6212	41.2830	42.9170	44.7544	47.7505	51.6432	55.1416 (72)
Total internal gains	730.0838	755.2111	720.2641	701.1221	663.6132	641.6550	615.8387	613.3557	632.5402	650.6511	689.3967	712.1270 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)						
East	18.4100	19.6403	0.6300	0.7000	0.7700	110.5027 (76)						
South	4.2900	46.7521	0.6300	0.7000	0.7700	61.2957 (78)						
West	12.0900	19.6403	0.6300	0.7000	0.7700	72.5680 (80)						
Solar gains	248.6561	466.7094	731.5857	1027.0618	1234.9055	1256.3235	1199.1034	1043.9178	836.2683	542.9803	306.2158	207.0896 (83)
Total gains	978.7399	1221.9206	1451.8499	1728.1839	1898.5187	1897.9785	1814.9421	1657.2735	1468.8085	1193.6314	995.6125	919.2166 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.4678	38.5401	38.6113	38.9491	39.0130	39.3131	39.3131	39.3692	39.1969	39.0130	38.8840	38.7501
util living area	3.5645	3.5693	3.5741	3.5966	3.6009	3.6209	3.6209	3.6246	3.6131	3.6009	3.5923	3.5833
util living area	0.9948	0.9881	0.9725	0.9262	0.8317	0.6782	0.5286	0.5889	0.8159	0.9589	0.9901	0.9959 (86)
MIT	18.8242	19.1029	19.5324	20.1001	20.5664	20.8569	20.9564	20.9356	20.7033	20.0595	19.3376	18.7807 (87)
Th 2	20.0512	20.0528	20.0543	20.0618	20.0632	20.0697	20.0697	20.0709	20.0672	20.0632	20.0604	20.0574 (88)
util rest of house	0.9937	0.9857	0.9666	0.9096	0.7933	0.6066	0.4294	0.4890	0.7599	0.9467	0.9877	0.9950 (89)
MIT 2	18.0386	18.3170	18.7435	19.3017	19.7365	19.9850	20.0520	20.0427	19.8691	19.2723	18.5574	17.9997 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.1727	18.4512	18.8783	19.4380	19.8782	20.1339	20.2065	20.1951	20.0115	19.4068	18.6906	18.1331 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1727	18.4512	18.8783	19.4380	19.8782	20.1339	20.2065	20.1951	20.0115	19.4068	18.6906	18.1331 (93)

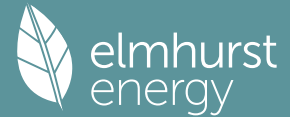
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9906	0.9799	0.9568	0.8962	0.7846	0.6119	0.4447	0.5032	0.7560	0.9354	0.9826	0.9924 (94)
Useful gains	969.5087	1197.3232	1389.1010	1548.7882	1489.6346	1161.4588	807.1626	833.9888	1110.4523	1116.5477	978.2431	912.2146 (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	3282.7200	3200.6149	2918.1922	2462.8035	1908.1720	1281.3343	835.0522	877.4840	1372.8299	2054.8315	2713.3410	3272.9777 (97)
Space heating kWh	1721.0292	1346.2120	1137.6439	658.0910	311.3918	0.0000	0.0000	0.0000	0.0000	698.0831	1249.2705	1756.4078 (98a)
Space heating requirement - total per year (kWh/year)	8878.1293											
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	1721.0292	1346.2120	1137.6439	658.0910	311.3918	0.0000	0.0000	0.0000	0.0000	698.0831	1249.2705	1756.4078 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8878.1293											
Space heating per m2	(98c) / (4) = 38.9734 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2176.5048	1713.4187	1757.2207	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7723	0.8434	0.8020	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1680.9606	1445.1330	1409.2505	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2115.5232	2022.6500	1842.6827	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	78.2213	107.4182	80.6184	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	266.2578 (107)											
Energy for space heating	38.9734 (99)											
Energy for space cooling	1.1688 (108)											
Total	40.1422 (109)											
Fabric Energy Efficiency (TFEE)	40.1 (109)											

Full SAP Calculation Printout



1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 580.2000 (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	5 * 10 =	50.0000 (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)	50.0000 / (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	0.3643	0.3572	0.3500	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	0.5368	0.5368	0.5349	0.5408	0.5472	0.5517	0.5564 (25)

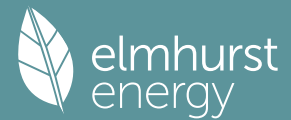
3. Heat losses and heat loss parameter

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
HGD			1.9100	1.2000	2.2920		(26a)
Windows (Uw = 1.20)			27.0800	1.1450	31.0076		(27)
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10.3397		(27)
Heatloss Floor 1			125.0000	0.1300	16.2500	110.0000	13750.0000 (28a)
Brick Facing	127.3500	22.2700	105.0800	0.1900	19.9652	60.0000	6304.8000 (29a)
Rendered	102.0300	13.8800	88.1500	0.1900	16.7485	60.0000	5289.0000 (29a)
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0.3260	9.0000	14.6700 (29a)
RIR Stud	7.6900		7.6900	0.2000	1.5380	9.0000	69.2100 (29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645	9.0000	872.5500 (30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180	9.0000	34.2000 (30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200	9.0000	18.0000 (30)
Slope Roof	2.9000		2.9000	0.1100	0.3190	9.0000	26.1000 (30)
Total net area of external elements Aum(A, m ²)			491.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	112.2885		(33)
Internal Wall 1			381.7200			9.0000	3435.4800 (32c)
Internal Floor 1			102.8000			18.0000	1850.4000 (32d)
Internal Ceiling 1			102.8000			9.0000	925.2000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	32769.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.8525 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	25.9100	0.3950	10.2345
E3 Sill	20.7000	0.0220	0.4554
E4 Jamb	59.8000	0.0170	1.0166
E5 Ground floor (normal)	52.4000	0.0840	4.4016
E6 Intermediate floor within a dwelling	42.4000	0.0010	0.0424
E16 Corner (normal)	43.0500	0.0460	1.9803
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690
E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0880	-1.9826
R6 Flat ceiling	2.3000	0.1200	0.2760
R7 Flat ceiling (inverted)	3.0000	0.1200	0.3600
R8 Roof to wall (rafter)	2.3000	0.1200	0.2760
R9 Roof to wall (flat ceiling)	3.0000	0.3200	0.9600
E13 Gable (insulation at rafter level)	1.4000	0.0500	0.0700
E14 Flat roof	12.8000	0.1600	2.0480
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			22.6071 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 134.8956 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.4404	107.9469	107.4633	105.1915	104.7664	102.7878	102.7878	102.4214	103.5499	104.7664	105.6263	106.5252 (38)
Heat transfer coeff	243.3360	242.8426	242.3589	240.0871	239.6621	237.6834	237.6834	237.3170	238.4456	239.6621	240.5219	241.4209 (39)
Average = Sum(39)m / 12 =												240.0851
HLP	1.0682	1.0660	1.0639	1.0539	1.0521	1.0434	1.0434	1.0418	1.0467	1.0521	1.0558	1.0598 (40)
HLP (average)												1.0539
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0381 (42)
Hot water usage for mixer showers												74.8704 (42a)
Hot water usage for baths												32.3341 (42b)
Hot water usage for other uses												45.7429 (42c)
Average daily hot water use (litres/day)												140.9584 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473 (44)
Energy content (annual)	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785 (45)
Distribution loss (46)m = 0.15 x (45)m	36.4291	32.0547	33.6785	28.7518	27.2795	23.9408	23.1784	24.4678	25.1414	28.7986	31.5509	35.9218 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7700 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9558 (55)
Enter (49) or (54) in (55)												
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298 (56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298 (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	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707 (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	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	123.0650	109.2735	116.9678	104.6820	102.7834	94.0176	93.6926	96.5506	96.6788	106.1506	110.8867	121.9404 (65)

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

Metabolic gains (Table 5), Watts	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5771	54.6922	44.4787	33.6732	25.1711	21.2505	22.9619	29.8468	40.0603	50.8658	59.3679	63.2885 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	592.1723	598.3172	582.8322	549.8666	508.2535	469.1430	443.0148	436.8699	452.3548	485.3204	526.9336	566.0441 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228 (71)
Water heating gains (Table 5)	165.4100	162.6093	157.2147	145.3917	138.1497	130.5800	125.9310	129.7724	134.2761	142.6755	154.0093	163.8983 (72)
Total internal gains	936.1872	932.6466	901.5535	845.9595	788.6022	738.0014	708.9356	713.5169	743.7192	795.8896	857.3386	910.2588 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3200	10.6334	0.7600	0.7000	0.7700	5.1748 (74)
East	9.3800	19.6403	0.7600	0.7000	0.7700	67.9196 (76)
South	4.2900	46.7521	0.7600	0.7000	0.7700	73.9440 (78)
West	12.0900	19.6403	0.7600	0.7000	0.7700	87.5424 (80)
East	9.0300	19.6403	0.7600	0.7000	0.7700	65.3853 (76)
Solar gains	299.9660	563.0146	882.5479	1238.9952	1489.7273	1515.5648
Total gains	1236.1532	1495.6611	1784.1014	2084.9546	2278.3295	2253.5663
						1446.5374
						1259.3294
						1008.8316
						655.0239
						369.4032
						249.8224 (83)
						1752.5508
						1450.9134
						1226.7418
						1160.0812 (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	37.4078	37.4838	37.5586	37.9140	37.9813	38.2975	38.2975	38.3566	38.1750	37.9813	37.8455	37.7046
alpha	3.4939	3.4989	3.5039	3.5276	3.5321	3.5532	3.5532	3.5571	3.5450	3.5321	3.5230	3.5136
util living area	0.9891	0.9783	0.9520	0.8873	0.7707	0.6098	0.4653	0.5211	0.7547	0.9324	0.9813	0.9912 (86)
Living	19.3679	19.5816	19.9241	20.3370	20.6546	20.8329	20.8899	20.8785	20.7367	20.2906	19.7459	19.3294
Non living	18.0958	18.3687	18.8018	19.3162	19.6864	19.8774	19.9244	19.9188	19.7882	19.2722	18.5860	18.0517
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1651	19.5816	19.9241	20.3370	20.6546	20.8329	20.8899	20.8785	20.7367	20.2906	19.7459	19.5631 (87)
Th 2	20.0269	20.0287	20.0304	20.0386	20.0402	20.0473	20.0473	20.0487	20.0446	20.0402	20.0371	20.0338 (88)
util rest of house	0.9869	0.9740	0.9422	0.8645	0.7258	0.5374	0.3725	0.4254	0.6910	0.9138	0.9768	0.9894 (89)
MIT 2	19.2570	18.3687	18.8018	19.3162	19.6864	19.8774	19.9244	19.9188	19.7882	19.2722	18.5860	18.4088 (90)

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Living area fraction										FLA = Living area / (4) =	0.1708 (91)	
MIT	19.4121	18.5758	18.9935	19.4906	19.8518	20.0405	20.0893	20.0827	19.9502	19.4461	18.7841	18.6059 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4121	18.5758	18.9935	19.4906	19.8518	20.0405	20.0893	20.0827	19.9502	19.4461	18.7841	18.6059 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9653	0.9291	0.8492	0.7160	0.5369	0.3767	0.4290	0.6839	0.8993	0.9689	0.9858	(94)
Useful gains	1217.8220	1443.7932	1657.5770	1770.6114	1631.3250	1209.9115	811.9899	846.4070	1198.6202	1304.7433	1188.5738	1143.6405	(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	3677.3187	3321.0739	3027.9053	2542.6550	1953.6708	1293.1261	829.3503	873.9703	1394.9563	2120.0679	2810.2747	3477.8960	(97)
Space heating kWh	1829.8655	1261.5326	1019.5243	555.8714	239.8253	0.0000	0.0000	0.0000	0.0000	606.6015	1167.6247	1736.6861	(98a)
Space heating requirement - total per year (kWh/year)												8417.5313	
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	1829.8655	1261.5326	1019.5243	555.8714	239.8253	0.0000	0.0000	0.0000	0.0000	606.6015	1167.6247	1736.6861	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8417.5313	
Space heating per m2												(98c) / (4) =	36.9514 (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 %)													329.7466 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1829.8655	1261.5326	1019.5243	555.8714	239.8253	0.0000	0.0000	0.0000	0.0000	606.6015	1167.6247	1736.6861	(98)
Space heating efficiency (main heating system 1)	329.7466	329.7466	329.7466	329.7466	329.7466	0.0000	0.0000	0.0000	0.0000	329.7466	329.7466	329.7466	(210)
Space heating fuel (main heating system)	554.9308	382.5763	309.1841	168.5753	72.7302	0.0000	0.0000	0.0000	0.0000	183.9599	354.0975	526.6729	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707	(64)
Efficiency of water heater	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	(216)
Fuel for water heating, kWh/month	184.4497	163.0697	173.0133	151.4654	146.4081	131.4625	129.3568	134.7174	136.4540	152.7238	163.1033	182.3403	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	53.8980	43.2390	38.9319	28.5232	22.0321	18.0004	20.0985	26.1247	33.9334	44.5225	50.2881	55.3960	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-45.3721	-66.8795	-98.9461	-113.0280	-122.3845	-111.2853	-110.1199	-102.6944	-89.7731	-76.7944	-50.6702	-38.8506	(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)	-10.5914	-23.3283	-47.1458	-73.2967	-100.6714	-105.3592	-104.7637	-89.5995	-67.4793	-36.3867	-15.0619	-8.4308	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2552.7269	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.3435	
Water heating fuel used												1848.5641	(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)													434.9880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1708.9128 (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													3127.3662 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2552.7269	16.4900	420.9447 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1848.5641	16.4900	304.8282 (247)

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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	434.9880	16.4900	71.7295 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1026.7982	16.4900	-169.3190
PV Unit electricity exported	-682.1146	5.5900	-38.1302
Total			-207.4492 (252)
Total energy cost			590.0532 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7787 (257)
SAP value		87.3779
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2552.7269	0.1555	397.0127 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1848.5641	0.1410	260.6032 (264)
Space and water heating			657.6159 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	434.9880	0.1443	62.7822 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1026.7982	0.1344	-138.0124
PV Unit electricity exported	-682.1146	0.1242	-84.7493
Total			-222.7617 (269)
Total CO2, kg/year			497.6364 (272)
CO2 emissions per m2			2.1800 (273)
EI value			97.5556
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	580.2000 (5)

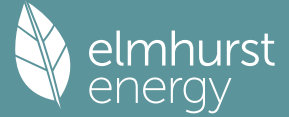
2. Ventilation rate

	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	5 * 10 = 50.0000 (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) =	50.0000 / (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	4.6000	4.1000	4.1000	4.0000	3.8000	3.3000	3.3000	3.2000	3.4000	3.9000	3.8000	3.9000 (22)
Wind factor	1.1500	1.0250	1.0250	1.0000	0.9500	0.8250	0.8250	0.8000	0.8500	0.9750	0.9500	0.9750 (22a)
Adj infilt rate	0.3286	0.2929	0.2929	0.2858	0.2715	0.2357	0.2357	0.2286	0.2429	0.2786	0.2715	0.2786 (22b)
Effective ac	0.5540	0.5429	0.5429	0.5408	0.5368	0.5278	0.5278	0.5261	0.5295	0.5388	0.5368	0.5388 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
HGD			1.9100	1.2000	2.2920		(26a)
Windows (Uw = 1.20)			27.0800	1.1450	31.0076		(27)
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10.3397		(27)
Heatloss Floor 1			125.0000	0.1300	16.2500	110.0000	13750.0000 (28a)
Brick Facing	127.3500	22.2700	105.0800	0.1900	19.9652	60.0000	6304.8000 (29a)
Rendered	102.0300	13.8800	88.1500	0.1900	16.7485	60.0000	5289.0000 (29a)
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0.3260	9.0000	14.6700 (29a)
RIR Stud	7.6900		7.6900	0.2000	1.5380	9.0000	69.2100 (29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645	9.0000	872.5500 (30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000 (30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180	9.0000	34.2000 (30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200	9.0000	18.0000 (30)
Slope Roof	2.9000		2.9000	0.1100	0.3190	9.0000	26.1000 (30)
Total net area of external elements Aum(A, m2)			491.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	112.2885		(33)
Internal Wall 1			381.7200			9.0000	3435.4800 (32c)
Internal Floor 1			102.8000			18.0000	1850.4000 (32d)
Internal Ceiling 1			102.8000			9.0000	925.2000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	32769.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.8525 (35)

List of Thermal Bridges	K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate		25.9100	0.3950	10.2345
E3 Sill		20.7000	0.0220	0.4554
E4 Jamb		59.8000	0.0170	1.0166
E5 Ground floor (normal)		52.4000	0.0840	4.4016
E6 Intermediate floor within a dwelling		42.4000	0.0010	0.0424
E16 Corner (normal)		43.0500	0.0460	1.9803
E10 Eaves (insulation at ceiling level)		41.1500	0.0600	2.4690
E17 Corner (inverted - internal area greater than external area)		22.5300	-0.0880	-1.9826
R6 Flat ceiling		2.3000	0.1200	0.2760
R7 Flat ceiling (inverted)		3.0000	0.1200	0.3600
R8 Roof to wall (rafter)		2.3000	0.1200	0.2760
R9 Roof to wall (flat ceiling)		3.0000	0.3200	0.9600
El3 Gable (insulation at rafter level)		1.4000	0.0500	0.0700
El4 Flat roof		12.8000	0.1600	2.0480
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				22.6071 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 134.8956 (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	106.0709	103.9457	103.9457	103.5499	102.7878	101.0534	101.0534	100.7358	101.3807	103.1640	102.7878	103.1640 (38)
Heat transfer coeff	240.9665	238.8413	238.8413	238.4456	237.6834	235.9490	235.9490	235.6315	236.2764	238.0596	237.6834	238.0596 (39)
Average = Sum(39)m / 12 =												237.6989

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0578	1.0485	1.0485	1.0467	1.0434	1.0358	1.0358	1.0344	1.0372	1.0450	1.0434	1.0450 (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	3.0381 (42)											
Hot water usage for mixer showers	75.1583	74.0288	72.3830	69.2339	66.9099	64.3183	62.8452	64.4786	66.2691	69.0518	72.2685	74.8704 (42a)
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341 (42b)
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429 (42c)
Average daily hot water use (litres/day)												140.9584 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473 (44)
Energy conte	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785 (45)
Energy content (annual)												Total = Sum(45)m = 2341.2890
Distribution loss (46)m = 0.15 x (45)m	36.4291	32.0547	33.6785	28.7518	27.2795	23.9408	23.1784	24.4678	25.1414	28.7986	31.5509	35.9218 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7700 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9558 (55)
Enter (49) or (54) in (55)												
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298 (56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298 (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	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707 (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	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707 (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	123.0650	109.2735	116.9678	104.6820	102.7834	94.0176	93.6926	96.5506	96.6788	106.1506	110.8867	121.9404 (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
Metabolic gains (Table 5), Watts												

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(66)m	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5771	54.6922	44.4787	33.6732	25.1711	21.2505	22.9619	29.8468	40.0603	50.8658	59.3679	63.2885	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	592.1723	598.3172	582.8322	549.8666	508.2535	469.1430	443.0148	436.8699	452.3548	485.3204	526.9336	566.0441	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	(71)
Water heating gains (Table 5)	165.4100	162.6093	157.2147	145.3917	138.1497	130.5800	125.9310	129.7724	134.2761	142.6755	154.0093	163.8983	(72)
Total internal gains	936.1872	932.6466	901.5535	845.9595	788.6022	738.0014	708.9356	713.5169	743.7192	795.8896	857.3386	910.2588	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	1.3200	12.4105	0.7600	0.7000	0.7700	6.0396 (74)							
East	9.3800	23.1112	0.7600	0.7000	0.7700	79.9228 (76)							
South	4.2900	52.9996	0.7600	0.7000	0.7700	83.8252 (78)							
West	12.0900	23.1112	0.7600	0.7000	0.7700	103.0135 (80)							
East	9.0300	23.1112	0.7600	0.7000	0.7700	76.9406 (76)							
Solar gains	349.7417	592.2986	912.4338	1304.2573	1521.2809	1660.9047	1547.4418	1363.5735	1105.2711	720.1269	427.0812	290.7327	(83)
Total gains	1285.9289	1524.9452	1813.9873	2150.2167	2309.8831	2398.9061	2256.3773	2077.0905	1848.9902	1516.0165	1284.4198	1200.9914	(84)

7. Mean internal temperature (heating season)

Utilisation 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	37.7757	38.1118	38.1118	38.1750	38.2975	38.5790	38.5790	38.6310	38.5255	38.2369	38.2975	38.2369	
alpha	3.5184	3.5408	3.5408	3.5450	3.5532	3.5719	3.5719	3.5754	3.5684	3.5491	3.5532	3.5491	
util living area	0.9859	0.9741	0.9396	0.8558	0.7099	0.4876	0.3301	0.3777	0.6605	0.9049	0.9748	0.9888 (86)	
Living	19.5021	19.7017	20.0693	20.4590	20.7441	20.8823	20.9082	20.9047	20.8190	20.4265	19.8816	19.4663	
Non living	18.2733	18.5318	18.9933	19.4666	19.7889	19.9243	19.9413	19.9411	19.8742	19.4413	18.7657	18.2353	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2337	19.7017	20.0693	20.4590	20.7441	20.8823	20.9082	20.9047	20.8190	20.4265	19.8816	19.6808 (87)	
Th 2	20.0354	20.0431	20.0431	20.0446	20.0473	20.0536	20.0536	20.0548	20.0524	20.0460	20.0473	20.0460 (88)	
util rest of house	0.9830	0.9688	0.9271	0.8268	0.6550	0.4073	0.2346	0.2764	0.5810	0.8784	0.9687	0.9864 (89)	
MIT 2	19.3329	18.5318	18.9933	19.4666	19.7889	19.9243	19.9413	19.9411	19.8742	19.4413	18.7657	18.5616 (90)	
Living area fraction									flA = Living area / (4) =			0.1708 (91)	
MIT	19.4868	18.7316	19.1770	19.6360	19.9520	20.0879	20.1064	20.1057	20.0356	19.6095	18.9562	18.7527 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.4868	18.7316	19.1770	19.6360	19.9520	20.0879	20.1064	20.1057	20.0356	19.6095	18.9562	18.7527 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9810	0.9593	0.9130	0.8125	0.6490	0.4104	0.2400	0.2820	0.5795	0.8635	0.9593	0.9822 (94)
Useful gains	1261.4659	1462.8923	1656.1763	1747.1330	1499.2290	984.4138	541.6211	585.6982	1071.4860	1309.0592	1232.0864	1179.5948 (95)
Ext temp.	5.0000	5.5000	7.4000	9.8000	12.8000	15.8000	17.8000	17.6000	15.1000	11.5000	7.8000	4.9000 (96)
Heat loss rate W	3490.8244	3160.2531	2812.8431	2345.3614	1699.9216	1011.7258	544.1934	590.4197	1166.1573	1930.5483	2651.6459	3297.7772 (97)
Space heating kWh	1658.6427	1140.6265	860.5601	430.7245	149.3152	0.0000	0.0000	0.0000	0.0000	462.3879	1022.0829	1575.9277 (98a)
Space heating requirement - total per year (kWh/year)												7300.2674
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	1658.6427	1140.6265	860.5601	430.7245	149.3152	0.0000	0.0000	0.0000	0.0000	462.3879	1022.0829	1575.9277 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7300.2674
Space heating per m2										(98c) / (4) =		32.0468 (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 %)													329.1192 (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	1658.6427	1140.6265	860.5601	430.7245	149.3152	0.0000	0.0000	0.0000	0.0000	462.3879	1022.0829	1575.9277 (98)	
Space heating efficiency (main heating system 1)	329.1192	329.1192	329.1192	329.1192	329.1192	0.0000	0.0000	0.0000	0.0000	329.1192	329.1192	329.1192 (210)	
Space heating fuel (main heating system)	503.9642	346.5694	261.4737	130.8719	45.3681	0.0000	0.0000	0.0000	0.0000	140.4925	310.5510	478.8319 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	

Water heating

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Water heating requirement	295.7531	261.4716	277.4155	242.8649	234.7558	210.7915	207.4151	216.0106	218.7951	244.8826	261.5254	292.3707 (64)
Efficiency of water heater (217)m	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076 (216)
Fuel for water heating, kWh/month	184.4910	163.1062	173.0520	151.4993	146.4408	131.4919	129.3857	134.7476	136.4845	152.7579	163.1397	182.3810 (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	53.8980	43.2390	38.9319	28.5232	22.0321	18.0004	20.0985	26.1247	33.9334	44.5225	50.2881	55.3960 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-51.2632	-68.7726	-99.7710	-115.1745	-122.0044	-117.7774	-114.6966	-107.8399	-95.1327	-81.1065	-56.5119	-43.8910 (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	-13.2902	-25.0960	-49.7489	-79.4202	-104.4844	-118.5454	-114.0088	-98.9269	-75.5476	-41.9896	-18.6637	-10.5543 (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												2218.1228 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												160.3076
Water heating fuel used												1848.9775 (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)												434.9880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1824.2176 (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												2677.8708 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2218.1228	21.5100	477.1182 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1848.9775	21.5100	397.7151 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	434.9880	21.5100	93.5659 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1073.9416	21.5100	-231.0048
PV Unit electricity exported	-750.2760	5.5900	-41.9404
Total			-272.9453 (252)
Total energy cost			695.4539 (255)

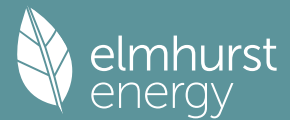
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2218.1228	0.1561	346.3558 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1848.9775	0.1410	260.6615 (264)
Space and water heating			607.0173 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	434.9880	0.1443	62.7822 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1073.9416	0.1345	-144.4659
PV Unit electricity exported	-750.2760	0.1244	-93.3019
Total			-237.7678 (269)
Total CO2, kg/year			432.0317 (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	2218.1228	1.5780	3500.3085 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1848.9775	1.5213	2812.8163 (278)
Space and water heating			6313.1248 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	434.9880	1.5338	667.1991 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1073.9416	1.4972	-1607.8521
PV Unit electricity exported	-750.2760	0.4563	-342.3767
Total			-1950.2288 (283)
Total Primary energy kWh/year			5030.0952 (286)

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SAP 10 EPC IMPROVEMENTS

Proposed

Current energy efficiency rating: B 87
 Current environmental impact rating: A 98

N Solar water heating Recommended
 U Solar photovoltaic panels Already installed
 V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
 N Solar water heating + 1.2 -£ 82 -50 kg (11.5%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£82	0.22 kg/m ²	B 89	A 98
Total Savings	£82	0.22 kg/m²		

Potential energy efficiency rating: B 89
 Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£968	£882	£86
Space heating	£477	£495	-£18
Water heating	£398	£294	£103
Lighting	£94	£94	£0
Generated (PV)	-£273	-£269	-£4
Total cost of fuels	£695	£613	£82
Total cost of uses	£696	£614	£81
Delivered energy	12 kWh/m ²	10 kWh/m ²	2 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m ²	2 kg/m ²	2 kg/m ²	0 kg/m ²
Primary energy	22 kWh/m ²	20 kWh/m ²	2 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	125.0000 (1b)	x 2.3800 (2b)	= 297.5000 (1b) - (3b)
First floor	102.8000 (1c)	x 2.7500 (2c)	= 282.7000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 580.2000 (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	5 * 10 = 50.0000 (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) = 50.0000 / (5) = 0.0862 (8)
 Pressure test
 Pressure Test Method
 Measured/design AP50
 Infiltration rate
 Number of sides sheltered
 Shelter factor
 Infiltration rate adjusted to include shelter factor

Blower Door
 Yes
 5.0000 (17)
 0.3362 (18)
 2 (19)

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
 (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	0.3643	0.3572	0.3500	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	0.5368	0.5368	0.5349	0.5408	0.5472	0.5517	0.5564 (25)

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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	
HGD			1,9100	1.2000	2,2920			(26a)
Windows (Uw = 1.20)			27.0800	1.1450	31,0076			(27)
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10,3397			(27)
Heatloss Floor 1			125.0000	0.1300	16,2500	110.0000	13750.0000	(28a)
Brick Facing	127.3500	22.2700	105.0800	0.1900	19,9652	60.0000	6304.8000	(29a)
Rendered	102.0300	13.8800	88.1500	0.1900	16,7485	60.0000	5289.0000	(29a)
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0,3260	9.0000	14.6700	(29a)
RIR Stud	7.6900		7.6900	0.2000	1,5380	9.0000	69.2100	(29a)
Plane Ceiling	96.9500		96.9500	0.1100	10,6645	9.0000	872.5500	(30)
GF Flat Roof	20.0000		20.0000	0.1100	2,2000	9.0000	180.0000	(30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0,4180	9.0000	34.2000	(30)
Adj To RIR	2.0000		2.0000	0.1100	0,2200	9.0000	18.0000	(30)
Slope Roof	2.9000		2.9000	0.1100	0,3190	9.0000	26.1000	(30)
Total net area of external elements Aum(A, m ²)			491.2200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	112.2885		(33)
Internal Wall 1			381.7200			9.0000	3435.4800	(32c)
Internal Floor 1			102.8000			18.0000	1850.4000	(32d)
Internal Ceiling 1			102.8000			9.0000	925.2000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	32769.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								143.8525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	25.9100	0.3950	10.2345	
E3 Sill	20.7000	0.0220	0.4554	
E4 Jamb	59.8000	0.0170	1.0166	
E5 Ground floor (normal)	52.4000	0.0840	4.4016	
E6 Intermediate floor within a dwelling	42.4000	0.0010	0.0424	
E16 Corner (normal)	43.0500	0.0460	1.9803	
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690	
E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0880	-1.9826	
R6 Flat ceiling	2.3000	0.1200	0.2760	
R7 Flat ceiling (inverted)	3.0000	0.1200	0.3600	
R8 Roof to wall (rafter)	2.3000	0.1200	0.2760	
R9 Roof to wall (flat ceiling)	3.0000	0.3200	0.9600	
E13 Gable (insulation at rafter level)	1.4000	0.0500	0.0700	
E14 Flat roof	12.8000	0.1600	2.0480	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				22.6071 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 134.8956 (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	108.4404	107.9469	107.4633	105.1915	104.7664	102.7878	102.7878	102.4214	103.5499	104.7664	105.6263	106.5252	(38)
Average = Sum(39)m / 12 =	243.3360	242.8426	242.3589	240.0871	239.6621	237.6834	237.6834	237.3170	238.4456	239.6621	240.5219	241.4209	(39)
													240.0851

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0682	1.0660	1.0639	1.0539	1.0521	1.0434	1.0434	1.0418	1.0467	1.0521	1.0558	1.0598	(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													3.0381 (42)
Hot water usage for mixer showers	75.1583	74.0288	72.3830	69.2339	66.9099	64.3183	62.8452	64.4786	66.2691	69.0518	72.2685	74.8704	(42a)
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341	(42b)
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429	(42c)
Average daily hot water use (litres/day)													140.9584 (43)
Daily hot water use	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473	(44)
Energy conte	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785	(45)
Energy content (annual)													Total = Sum(45)m = 2341.2890
Distribution loss (46)m = 0.15 x (45)m	36.4291	32.0547	33.6785	28.7518	27.2795	23.9408	23.1784	24.4678	25.1414	28.7986	31.5509	35.9218	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7700 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9558 (55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	295.7531	261.4716	276.0198	236.1113	221.9614	198.1848	194.3882	203.9142	213.3922	243.4868	261.5254	292.3707	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													633.6974 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													633.6974

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Solar input	-0.0000	-16.1905	-58.9470	-81.5307	-107.1681	-98.8667	-98.1858	-85.4891	-58.5588	-28.7608	-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	295.7531	245.2811	217.0728	154.5806	114.7934	99.3180	96.2024	118.4251	154.8334	214.7261	261.5254	292.3707 (64)
												Total per year (kWh/year) = Sum(64)m = 2264.8821 (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	123.0650	109.2735	115.8512	99.2792	92.5479	83.9323	83.2711	86.8735	92.3565	105.0340	110.8867	121.9404 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5771	54.6922	44.4787	33.6732	25.1711	21.2505	22.9619	29.8468	40.0603	50.8658	59.3679	63.2885 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	592.1723	598.3172	582.8322	549.8666	508.2535	469.1430	443.0148	436.8699	452.3548	485.3204	526.9336	566.0441 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228 (71)
Water heating gains (Table 5)	165.4100	162.6093	155.7139	137.8877	124.3924	116.5726	111.9235	116.7654	128.2729	141.1747	154.0093	163.8983 (72)
Total internal gains	936.1872	932.6466	900.0527	838.4555	774.8449	723.9940	694.9281	700.5100	737.7160	794.3888	857.3386	910.2588 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		1.3200	10.6334	0.7600	0.7000	0.7700	5.1748 (74)					
East		9.3800	19.6403	0.7600	0.7000	0.7700	67.9196 (76)					
South		4.2900	46.7521	0.7600	0.7000	0.7700	73.9440 (78)					
West		12.0900	19.6403	0.7600	0.7000	0.7700	87.5424 (80)					
East		9.0300	19.6403	0.7600	0.7000	0.7700	65.3853 (76)					
Solar gains	299.9660	563.0146	882.5479	1238.9952	1489.7273	1515.5648	1446.5374	1259.3294	1008.8316	655.0239	369.4032	249.8224 (83)
Total gains	1236.1532	1495.6611	1782.6006	2077.4506	2264.5722	2239.5588	2141.4655	1959.8394	1746.5476	1449.4126	1226.7418	1160.0812 (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	37.4078	37.4838	37.5586	37.9140	37.9813	38.2975	38.2975	38.3566	38.1750	37.9813	37.8455	37.7046
alpha	3.4939	3.4989	3.5039	3.5276	3.5321	3.5532	3.5532	3.5571	3.5450	3.5321	3.5230	3.5136
util living area	0.9891	0.9783	0.9521	0.8882	0.7731	0.6127	0.4680	0.5239	0.7561	0.9325	0.9813	0.9912 (86)
Living	19.3679	19.5816	19.9234	20.3344	20.6518	20.8317	20.8894	20.8779	20.7356	20.2900	19.7459	19.3294
Non living	18.0958	18.3687	18.8010	19.3132	19.6835	19.8764	19.9242	19.9185	19.7872	19.2714	18.5860	18.0517
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1651	19.5816	19.9234	20.3344	20.6518	20.8317	20.8894	20.8779	20.7356	20.2900	19.7459	19.5631 (87)
Th 2	20.0269	20.0287	20.0304	20.0386	20.0402	20.0473	20.0473	20.0487	20.0446	20.0402	20.0371	20.0338 (88)
util rest of house	0.9869	0.9740	0.9424	0.8656	0.7284	0.5402	0.3747	0.4280	0.6925	0.9140	0.9768	0.9894 (89)
MIT 2	19.2570	18.3687	18.8010	19.3132	19.6835	19.8764	19.9242	19.9185	19.7872	19.2714	18.5860	18.4088 (90)
Living area fraction									fLA = Living area / (4) =			0.1708 (91)
MIT	19.4121	18.5758	18.9927	19.4876	19.8489	20.0395	20.0890	20.0823	19.9491	19.4454	18.7841	18.6059 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4121	18.5758	18.9927	19.4876	19.8489	20.0395	20.0890	20.0823	19.9491	19.4454	18.7841	18.6059 (93)

8. Space heating requirement

Utilisation	0.9852	0.9653	0.9292	0.8503	0.7185	0.5396	0.3790	0.4316	0.6854	0.8995	0.9689	0.9858 (94)
Useful gains	1217.8220	1443.7932	1656.4308	1766.4040	1627.0324	1208.3710	811.5915	845.7944	1197.0340	1303.7211	1188.5738	1143.6405 (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	3677.3187	3321.0739	3027.7109	2541.9494	1952.9775	1292.8885	829.2877	873.8747	1394.7017	2119.8955	2810.2747	3477.8960 (97)
Space heating kWh	1829.8655	1261.5326	1020.2324	558.3927	242.5031	0.0000	0.0000	0.0000	0.0000	607.2337	1167.6247	1736.6861 (98a)
Space heating requirement - total per year (kWh/year)												8424.0707
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	1829.8655	1261.5326	1020.2324	558.3927	242.5031	0.0000	0.0000	0.0000	0.0000	607.2337	1167.6247	1736.6861 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8424.0707
Space heating per m2												(98c) / (4) = 36.9801 (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 %)	329.7466 (206)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1829.8655	1261.5326	1020.2324	558.3927	242.5031	0.0000	0.0000	0.0000	0.0000	607.2337	1167.6247	1736.6861	(98)
Space heating efficiency (main heating system 1)	329.7466	329.7466	329.7466	329.7466	329.7466	0.0000	0.0000	0.0000	0.0000	329.7466	329.7466	329.7466	(210)
Space heating fuel (main heating system)	554.9308	382.5763	309.3989	169.3399	73.5423	0.0000	0.0000	0.0000	0.0000	184.1516	354.0975	526.6729	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	295.7531	245.2811	217.0728	154.5806	114.7934	99.3180	96.2024	118.4251	154.8334	214.7261	261.5254	292.3707	(64)
Efficiency of water heater	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	160.3435	(216)
Fuel for water heating, kWh/month	184.4497	152.9723	135.3799	96.4059	71.5922	61.9408	59.9977	73.8571	96.5636	133.9163	163.1033	182.3403	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	53.8980	43.2390	38.9319	28.5232	22.0321	18.0004	20.0985	26.1247	33.9334	44.5225	50.2881	55.3960	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-45.3983	-66.8392	-98.3133	-111.1477	-118.1612	-106.1934	-105.0144	-98.9264	-88.0385	-76.5556	-50.7159	-38.8726	(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)	-10.5651	-23.3686	-47.7785	-75.1771	-104.8947	-110.4511	-109.8692	-93.3675	-69.2139	-36.6255	-15.0162	-8.4088	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													2554.7101 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													160.3435
Water heating fuel used													1412.5190 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													434.9880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1708.9128 (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													2773.3043 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2554.7101	16.4900	421.2717	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1412.5190	16.4900	232.9244	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	434.9880	16.4900	71.7295	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1004.1765	16.4900	-165.5887	
PV Unit electricity exported	-704.7363	5.5900	-39.3948	
Total			-204.9835	(252)
Total energy cost			534.1341	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.7049	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	88.5741	
SAP rating (Section 12)		89	(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	2554.7101	0.1555	397.2882	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1412.5190	0.1453	205.1983	(264)
Space and water heating			602.4864	(265)

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Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	434.9880	0.1443	62.7822 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1004.1765	0.1347	-135.2537
PV Unit electricity exported	-704.7363	0.1238	-87.2666
Total			-222.5203 (269)
Total CO2, kg/year			453.8453 (272)
CO2 emissions per m2			1.9900 (273)
EI value			97.7707
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	125.0000 (1b)	x	2.3800 (2b)	=	297.5000 (1b)	- (3b)
First floor	102.8000 (1c)	x	2.7500 (2c)	=	282.7000 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	227.8000				(4)	
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 580.2000 (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	5 * 10 =											50.0000 (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) =	50.0000 / (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	4.6000	4.1000	4.1000	4.0000	3.8000	3.3000	3.3000	3.2000	3.4000	3.9000	3.8000	3.9000 (22)
Adj infilt rate	1.1500	1.0250	1.0250	1.0000	0.9500	0.8250	0.8250	0.8000	0.8500	0.9750	0.9500	0.9750 (22a)
Effective ac	0.3286	0.2929	0.2929	0.2858	0.2715	0.2357	0.2357	0.2286	0.2429	0.2786	0.2715	0.2786 (22b)
	0.5540	0.5429	0.5429	0.5408	0.5368	0.5278	0.5278	0.5261	0.5295	0.5388	0.5368	0.5388 (25)

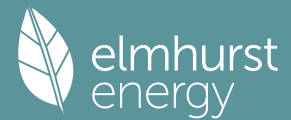
3. Heat losses and heat loss parameter

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	
HGD			1.9100	1.2000	2.2920			(26a)
Windows (Uw = 1.20)			27.0800	1.1450	31.0076			(27)
Fully Glazed Doors (Uw = 1.20)			9.0300	1.1450	10.3397			(27)
Heatloss Floor 1			125.0000	0.1300	16.2500	110.0000	13750.0000	(28a)
Brick Facing	127.3500	22.2700	105.0800	0.1900	19.9652	60.0000	6304.8000	(29a)
Rendered	102.0300	13.8800	88.1500	0.1900	16.7485	60.0000	5289.0000	(29a)
Dormer Walls	3.5000	1.8700	1.6300	0.2000	0.3260	9.0000	14.6700	(29a)
RIR Stud	7.6900		7.6900	0.2000	1.5380	9.0000	69.2100	(29a)
Plane Ceiling	96.9500		96.9500	0.1100	10.6645	9.0000	872.5500	(30)
GF Flat Roof	20.0000		20.0000	0.1100	2.2000	9.0000	180.0000	(30)
Dormer Flat Roof	3.8000		3.8000	0.1100	0.4180	9.0000	34.2000	(30)
Adj To RIR	2.0000		2.0000	0.1100	0.2200	9.0000	18.0000	(30)
Slope Roof	2.9000		2.9000	0.1100	0.3190	9.0000	26.1000	(30)
Total net area of external elements Aum(A, m2)			491.2200					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	112.2885		(33)
Internal Wall 1			381.7200			9.0000	3435.4800	(32c)
Internal Floor 1			102.8000			18.0000	1850.4000	(32d)
Internal Ceiling 1			102.8000			9.0000	925.2000	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	32769.6100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								143.8525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	25.9100	0.3950	10.2345
E3 Sill	20.7000	0.0220	0.4554
E4 Jamb	59.8000	0.0170	1.0166
E5 Ground floor (normal)	52.4000	0.0840	4.4016
E6 Intermediate floor within a dwelling	42.4000	0.0010	0.0424
E16 Corner (normal)	43.0500	0.0460	1.9803
E10 Eaves (insulation at ceiling level)	41.1500	0.0600	2.4690

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E17 Corner (inverted - internal area greater than external area)	22.5300	-0.0880	-1.9826	
R6 Flat ceiling	2.3000	0.1200	0.2760	
R7 Flat ceiling (inverted)	3.0000	0.1200	0.3600	
R8 Roof to wall (rafter)	2.3000	0.1200	0.2760	
R9 Roof to wall (flat ceiling)	3.0000	0.3200	0.9600	
E13 Gable (insulation at rafter level)	1.4000	0.0500	0.0700	
E14 Flat roof	12.8000	0.1600	2.0480	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				22.6071 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		134.8956 (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	106.0709	103.9457	103.9457	103.5499	102.7878	101.0534	101.0534	100.7358	101.3807	103.1640	102.7878	103.1640 (38)
Average = Sum(39)m / 12 =	240.9665	238.8413	238.8413	238.4456	237.6834	235.9490	235.9490	235.6315	236.2764	238.0596	237.6834	238.0596 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0578	1.0485	1.0485	1.0467	1.0434	1.0358	1.0358	1.0344	1.0372	1.0450	1.0434	1.0450 (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 3.0381 (42)

Hot water usage for mixer showers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	75.1583	74.0288	72.3830	69.2339	66.9099	64.3183	62.8452	64.4786	66.2691	69.0518	72.2685	74.8704 (42a)
Hot water usage for baths	32.4438	31.9619	31.2834	30.0323	29.0955	28.0568	27.4957	28.1695	28.9031	30.0146	31.2914	32.3341 (42b)
Hot water usage for other uses	45.7429	44.0795	42.4161	40.7527	39.0894	37.4260	37.4260	39.0894	40.7527	42.4161	44.0795	45.7429 (42c)
Average daily hot water use (litres/day)												140.9584 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	153.3449	150.0702	146.0825	140.0189	135.0948	129.8010	127.7668	131.7374	135.9250	141.4825	147.6394	152.9473 (44)
Energy content	242.8609	213.6980	224.5233	191.6789	181.8636	159.6055	154.5229	163.1184	167.6091	191.9904	210.3394	239.4785 (45)
Energy content (annual)												Total = Sum(45)m = 2341.2890
Distribution loss (46)m = 0.15 x (45)m	36.4291	32.0547	33.6785	28.7518	27.2795	23.9408	23.1784	24.4678	25.1414	28.7986	31.5509	35.9218 (46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7700 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9558 (55)

Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298 (56)
If cylinder contains dedicated solar storage												
29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	15.7584	9.9053	10.2355	11.1660	17.1091	21.8667	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												
295.7531	261.4716	276.0198	236.1113	221.9614	198.1848	194.3882	203.9142	213.3922	243.4868	261.5254	292.3707 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												
Zero-loss collector efficiency												
Collector linear heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector loop efficiency												
Incidence angle modifier												
Overshading factor												
Overall heat loss coefficient of system												
Heat loss coefficient of collector loop												
Dedicated solar storage volume												
Effective solar volume												
Reference volume												
Storage tank correction coefficient												
Heat delivered to hot water												
Heat delivered to space heating												
Solar input												
Solar input	-0.0000	-19.6230	-63.1369	-88.2603	-111.0748	-110.9480	-107.3757	-95.7277	-68.3751	-36.9682	-4.0650	-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	295.7531	241.8487	212.8829	147.8510	110.8867	87.2368	87.0125	108.1865	145.0171	206.5186	257.4604	292.3707 (64)
Total per year (kWh/year) = Sum(64)m = 2193.0249 (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

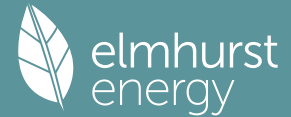
123.0650	109.2735	115.8512	99.2792	92.5479	83.9323	83.2711	86.8735	92.3565	105.0340	110.8867	121.9404 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842	182.2842 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
61.5771	54.6922	44.4787	33.6732	25.1711	21.2505	22.9619	29.8468	40.0603	50.8658	59.3679	63.2885 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
592.1723	598.3172	582.8322	549.8666	508.2535	469.1430	443.0148	436.8699	452.3548	485.3204	526.9336	566.0441 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665	56.2665 (69)	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)												
-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228	-121.5228 (71)	
Water heating gains (Table 5)												
165.4100	162.6093	155.7139	137.8877	124.3924	116.5726	111.9235	116.7654	128.2729	141.1747	154.0093	163.8983 (72)	
Total internal gains	936.1872	932.6466	900.0527	838.4555	774.8449	723.9940	694.9281	700.5100	737.7160	794.3888	857.3386	910.2588 (73)

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6. Solar gains

[Jan]												Gains
												W
	Area	Solar flux		g		FF		Access		Gains		
	m2	Table 6a		Specific data		Specific data		factor		W		
		W/m2		or Table 6b		or Table 6c		Table 6d				
North	1.3200	12.4105		0.7600		0.7000		0.7700		6.0396 (74)		
East	9.3800	23.1112		0.7600		0.7000		0.7700		79.9228 (76)		
South	4.2900	52.9996		0.7600		0.7000		0.7700		83.8252 (78)		
West	12.0900	23.1112		0.7600		0.7000		0.7700		103.0135 (80)		
East	9.0300	23.1112		0.7600		0.7000		0.7700		76.9406 (76)		
Solar gains	349.7417	592.2986	912.4338	1304.2573	1521.2809	1660.9047	1547.4418	1363.5735	1105.2711	720.1269	427.0812	290.7327 (83)
Total gains	1285.9289	1524.9452	1812.4865	2142.7127	2296.1258	2384.8986	2242.3699	2064.0836	1842.9870	1514.5157	1284.4198	1200.9914 (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	37.7757	38.1118	38.1118	38.1750	38.2975	38.5790	38.5790	38.6310	38.5255	38.2369	38.2975	38.2369
alpha	3.5184	3.5408	3.5408	3.5450	3.5532	3.5719	3.5719	3.5754	3.5684	3.5491	3.5532	3.5491
util living area	0.9859	0.9741	0.9397	0.8568	0.7125	0.4900	0.3321	0.3800	0.6620	0.9051	0.9748	0.9888 (86)
Living	19.5021	19.7017	20.0687	20.4568	20.7420	20.8818	20.9081	20.9046	20.8183	20.4259	19.8816	19.4663
Non living	18.2733	18.5318	18.9925	19.4640	19.7870	19.9240	19.9413	19.9411	19.8737	19.4406	18.7657	18.2353
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2337	19.7017	20.0687	20.4568	20.7420	20.8818	20.9081	20.9046	20.8183	20.4259	19.8816	19.6808 (87)
Th 2	20.0354	20.0431	20.0431	20.0446	20.0473	20.0536	20.0536	20.0548	20.0524	20.0460	20.0473	20.0460 (88)
util rest of house	0.9830	0.9688	0.9272	0.8280	0.6577	0.4095	0.2361	0.2781	0.5825	0.8786	0.9687	0.9864 (89)
MIT 2	19.3329	18.5318	18.9925	19.4640	19.7870	19.9240	19.9413	19.9411	19.8737	19.4406	18.7657	18.5616 (90)
Living area fraction	fLA = Living area / (4) = 0.1708 (91)											
MIT	19.4868	18.7316	19.1763	19.6335	19.9500	20.0875	20.1064	20.1056	20.0350	19.6089	18.9562	18.7527 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4868	18.7316	19.1763	19.6335	19.9500	20.0875	20.1064	20.1056	20.0350	19.6089	18.9562	18.7527 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9810	0.9593	0.9132	0.8137	0.6516	0.4125	0.2415	0.2837	0.5809	0.8638	0.9593	0.9822 (94)
Useful gains	1261.4659	1462.8923	1655.0998	1743.5240	1496.2112	983.8664	541.5577	585.5842	1070.6192	1308.1715	1232.0864	1179.5948 (95)
Ext temp.	5.0000	5.5000	7.4000	9.8000	12.8000	15.8000	17.8000	17.6000	15.1000	11.5000	7.8000	4.9000 (96)
Heat loss rate W	3490.8244	3160.2531	2812.6622	2344.7643	1699.4464	1011.6421	544.1824	590.4006	1166.0222	1930.3996	2651.6459	3297.7772 (97)
Space heating kWh	1658.6427	1140.6265	861.2264	432.8931	151.2069	0.0000	0.0000	0.0000	0.0000	462.9377	1022.0829	1575.9277 (98a)
Space heating requirement - total per year (kWh/year)	7305.5439											
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	1658.6427	1140.6265	861.2264	432.8931	151.2069	0.0000	0.0000	0.0000	0.0000	462.9377	1022.0829	1575.9277 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	7305.5439											
Space heating per m2	(98c) / (4) = 32.0700 (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 %) 329.1192 (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	1658.6427	1140.6265	861.2264	432.8931	151.2069	0.0000	0.0000	0.0000	0.0000	462.9377	1022.0829	1575.9277 (98)
Space heating efficiency (main heating system 1)	329.1192	329.1192	329.1192	329.1192	329.1192	0.0000	0.0000	0.0000	0.0000	329.1192	329.1192	329.1192 (210)
Space heating fuel (main heating system)	503.9642	346.5694	261.6762	131.5308	45.9429	0.0000	0.0000	0.0000	0.0000	140.6596	310.5510	478.8319 (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	295.7531	241.8487	212.8829	147.8510	110.8867	87.2368	87.0125	108.1865	145.0171	206.5186	257.4604	292.3707 (64)
Efficiency of water heater												
(217)m	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076	160.3076 (217)
Fuel for water heating, kWh/month	184.4910	150.8654	132.7965	92.2296	69.1712	54.4184	54.2784	67.4868	90.4618	128.8264	160.6040	182.3810 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	53.8980	43.2390	38.9319	28.5232	22.0321	18.0004	20.0985	26.1247	33.9334	44.5225	50.2881	55.3960 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-51.2972	-68.7037	-99.0124	-112.8554	-117.2640	-111.4143	-108.6628	-103.2134	-92.8469	-80.6913	-56.5479	-43.9193 (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)

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Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-13.2562	-25.1650	-50.5075	-81.7394	-109.2248	-124.9085	-120.0425	-103.5533	-77.8335	-42.4048	-18.6277	-10.5260	(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												2219.7260	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.3076	
Water heating fuel used												1368.0104	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												434.9880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1824.2176	(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												2278.5068	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2219.7260	21.5100	477.4631	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1368.0104	21.5100	294.2590	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	434.9880	21.5100	93.5659	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1046.4284	21.5100	-225.0868	
PV Unit electricity exported	-777.7892	5.5900	-43.4784	
Total			-268.5652	(252)
Total energy cost			613.9308	(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	2219.7260	0.1561	346.5796	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1368.0104	0.1458	199.4974	(264)
Space and water heating			546.0770	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	434.9880	0.1443	62.7822	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1046.4284	0.1348	-141.1102	
PV Unit electricity exported	-777.7892	0.1239	-96.3644	
Total			-237.4746	(269)
Total CO2, kg/year			382.4816	(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	2219.7260	1.5780	3502.7401	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1368.0104	1.5394	2105.9793	(278)
Space and water heating			5608.7193	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	434.9880	1.5338	667.1991	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1046.4284	1.4984	-1567.9608	
PV Unit electricity exported	-777.7892	0.4546	-353.5875	
Total			-1921.5483	(283)
Total Primary energy kWh/year			4475.3942	(286)