

Full SAP Calculation Printout



Property Reference	25500		Issued on Date	10/10/2023	
Assessment Reference	00001	Prop Type Ref			
Property	Land at 16 Coast View, Stratton Road, Bude, Cornwall, EX23 8AG				
SAP Rating	110 A	DER	-3.44	TER	12.09
Environmental	103 A	% DER < TER			128.45
CO ₂ Emissions (t/year)	-0.39	DFEE	34.02	TFEE	41.77
Compliance Check	See BREL	% DFEE < TFEE			18.55
% DPER < TPER	132.98	DPER	-20.85	TPER	63.22
Assessor Details	Mr. Benjamin Marsh			Assessor ID	E695-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.9000 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test		Yes										
Pressure Test Method		Blower Door										
Measured/design AP50		2.0000 (17)										
Infiltration rate		0.1000 (18)										
Number of sides sheltered		0 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1000 (21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1275	0.1250	0.1225	0.1100	0.1075	0.0950	0.0950	0.0925	0.1000	0.1075	0.1125	0.1175 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.2135	0.2110	0.2085	0.1960	0.1935	0.1810	0.1810	0.1785	0.1860	0.1935	0.1985	0.2035 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			16.3400	1.1450	18.7099		(27)
Half Glazed Door			1.7000	1.2000	2.0400		(26a)

Full SAP Calculation Printout



Ground Floor				43.7800	0.1200	5.2536	110.0000	4815.8000 (28a)
R-Wall	142.0000	18.0400		123.9600	0.1400	17.3544	17.0000	2107.3200 (29a)
Cold roof	43.7800			43.7800	0.0900	3.9402	9.0000	394.0200 (30)
Total net area of external elements Aum(A, m2)				229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		47.2981		(33)
Internal Wall 1				152.1800			9.0000	1369.6200 (32c)
Internal Floor 1				43.7800			18.0000	788.0400 (32d)
Internal Ceiling 1				43.7800			9.0000	394.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9868.8200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0140	0.1841
E3 Sill	12.3000	0.0460	0.5658
E4 Jamb	25.0000	0.0050	0.1250
E5 Ground floor (normal)	28.4000	0.0640	1.8176
E6 Intermediate floor within a dwelling	28.4000	0.0490	1.3916
E10 Eaves (insulation at ceiling level)	28.4000	0.0520	1.4768
E16 Corner (normal)	25.0000	0.0420	1.0500
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0790	0.3950

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0059 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 54.3040 (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	15.4226	15.2420	15.0614	14.1585	13.9779	13.0749	13.0749	12.8943	13.4361	13.9779	14.3390	14.7002 (38)
Average = Sum(39)m / 12 =	69.7266	69.5460	69.3654	68.4625	68.2819	67.3789	67.3789	67.1983	67.7401	68.2819	68.6431	69.0043 (39)
												68.4173

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7963	0.7943	0.7922	0.7819	0.7798	0.7695	0.7695	0.7675	0.7736	0.7798	0.7840	0.7881 (40)
HLP (average)												0.7814
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5908 (42)

Hot water usage for mixer showers 67.6594 66.6426 65.1610 62.3261 60.2340 57.9009 56.5748 58.0453 59.6571 62.1621 65.0579 67.4002 (42a)

Hot water usage for baths 29.2190 28.7850 28.1740 27.0472 26.2036 25.2680 24.7627 25.3695 26.0302 27.0313 28.1812 29.1202 (42b)

Hot water usage for other uses 41.1627 39.6658 38.1690 36.6722 35.1754 33.6785 33.6785 35.1754 36.6722 38.1690 39.6658 41.1627 (42c)

Average daily hot water use (litres/day) 126.8909 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	138.0411	135.0935	131.5039	126.0455	121.6129	116.8475	115.0161	118.5902	122.3596	127.3624	132.9050	137.6830 (44)
Energy content (annual)	218.6233	192.3713	202.1166	172.5500	163.7144	143.6776	139.1020	146.8394	150.8816	172.8296	189.3475	215.5784 (45)
Distribution loss (46)m = 0.15 x (45)m	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368 (46)

Water storage loss:
 Store volume 170.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.9500 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 1.0530 (55)

Total storage loss	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (64)
Total per year (kWh/year) = Sum(64)m =												2491.9767 (64)
												2492 (64)

12Total per year (kWh/year)
 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 72.6922 63.9635 67.2038 57.3729 54.4350 47.7728 46.2514 48.8241 50.1681 57.4658 62.9580 71.6798 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414 (66)

Full SAP Calculation Printout



Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	120.1532	133.0267	120.1532	124.1583	120.1532	124.1583	120.1532	120.1532	124.1583	120.1532	124.1583	120.1532 (67)
234.5165	236.9500	230.8175	217.7623	201.2823	185.7935	175.4460	173.0125	179.1449	192.2002	208.6801	224.1690 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541 (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)	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331 (71)	
Water heating gains (Table 5)	97.7046	95.1837	90.3277	79.6845	73.1654	66.3511	62.1659	65.6238	69.6780	77.2390	87.4417	96.3438 (72)
Total internal gains	514.2367	527.0229	503.1608	483.4675	456.4633	438.1653	419.6275	420.6518	434.8436	451.4548	482.1426	502.5284 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.7900	10.6334	0.6300	0.7000	0.7700	18.8158 (74)	
East	1.8900	19.6403	0.6300	0.7000	0.7700	11.3444 (76)	
South	8.6600	46.7521	0.6300	0.7000	0.7700	123.7344 (78)	

Solar gains	153.8946	260.7950	355.7823	443.1935	501.5515	500.9808	481.6684	437.1367	385.6207	287.7077	184.0243	131.9328 (83)
Total gains	668.1313	787.8179	858.9431	926.6610	958.0148	939.1462	901.2959	857.7885	820.4642	739.1625	666.1668	634.4612 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	39.3155	39.4176	39.5202	40.0415	40.1474	40.6854	40.6854	40.7947	40.4685	40.1474	39.9361	39.7271
tau	3.6210	3.6278	3.6347	3.6694	3.6765	3.7124	3.7124	3.7196	3.6979	3.6765	3.6624	3.6485
util living area	0.9382	0.8970	0.8414	0.7398	0.6051	0.4450	0.3254	0.3551	0.5367	0.7701	0.9004	0.9466 (86)
Living	19.9305	20.1581	20.3961	20.6530	20.8143	20.8923	20.9110	20.9088	20.8667	20.6566	20.2641	19.8894
Non living	18.9937	19.2769	19.5698	19.8827	20.0656	20.1538	20.1697	20.1701	20.1272	19.8949	19.4201	18.9479
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	20.4529	20.1581	20.3961	20.6530	20.8143	20.8923	20.9110	20.9088	20.8667	20.6566	20.2641	20.0447 (87)
Th 2	20.2565	20.2583	20.2601	20.2691	20.2708	20.2798	20.2798	20.2816	20.2762	20.2708	20.2673	20.2637 (88)
util rest of house	0.9304	0.8849	0.8235	0.7127	0.5678	0.3988	0.2734	0.3015	0.4883	0.7398	0.8867	0.9396 (89)
MIT 2	19.7531	19.2769	19.5698	19.8827	20.0656	20.1538	20.1697	20.1701	20.1272	19.8949	19.4201	19.1850 (90)
Living area fraction	20.0215	19.6149	19.8867	20.1781	20.3527	20.4370	20.4540	20.4534	20.4108	20.1870	19.7437	0.3835 (91)
MIT	20.0215	19.6149	19.8867	20.1781	20.3527	20.4370	20.4540	20.4534	20.4108	20.1870	19.7437	19.5147 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0215	19.6149	19.8867	20.1781	20.3527	20.4370	20.4540	20.4534	20.4108	20.1870	19.7437	19.5147 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9276	0.8731	0.8137	0.7092	0.5721	0.4090	0.2861	0.3145	0.4975	0.7361	0.8755	0.9315 (94)
Useful gains	619.7891	687.8142	698.9233	657.1528	548.0601	384.1087	257.8501	269.7629	408.2179	544.0744	583.2459	590.9921 (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	1096.2040	1023.3612	928.5748	772.1292	590.8235	393.2912	259.6774	272.3814	427.4953	654.6216	867.9056	1056.7814 (97)
Space heating kWh	354.4527	225.4876	170.8607	82.7830	31.8160	0.0000	0.0000	0.0000	0.0000	82.2471	204.9550	346.5472 (98a)
Space heating requirement - total per year (kWh/year)												1499.1493
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	354.4527	225.4876	170.8607	82.7830	31.8160	0.0000	0.0000	0.0000	0.0000	82.2471	204.9550	346.5472 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1499.1493
Space heating per m ²										(98c) / (4) =		17.1214 (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 %)	329.6631 (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												

Full SAP Calculation Printout



Space heating efficiency (main heating system 1)	354.4527	225.4876	170.8607	82.7830	31.8160	0.0000	0.0000	0.0000	0.0000	82.2471	204.9550	346.5472	(98)
Space heating fuel (main heating system)	329.6631	329.6631	329.6631	329.6631	329.6631	0.0000	0.0000	0.0000	0.0000	329.6631	329.6631	329.6631	(210)
Space heating efficiency (main heating system 2)	107.5197	68.3994	51.8289	25.1114	9.6511	0.0000	0.0000	0.0000	0.0000	24.9488	62.1710	105.1216	(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													
Water heating requirement	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	(64)
Efficiency of water heater (217)m	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	(216)
Fuel for water heating, kWh/month	88.7091	78.3257	82.8815	72.0713	69.3236	61.8779	60.6343	63.3660	64.4213	72.5418	78.0016	87.6341	(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	19.6877	17.7824	19.6877	19.0526	19.6877	19.0526	19.6877	19.6877	19.0526	19.6877	19.0526	19.6877	(231)
Lighting	23.2305	18.6364	16.7800	12.2937	9.4960	7.7583	8.6626	11.2600	14.6256	19.1896	21.6746	23.8761	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-111.3940	-167.2685	-247.9727	-274.2168	-283.7048	-256.0649	-252.7304	-244.8958	-223.5258	-191.9978	-125.7543	-94.6692	(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	-13.8223	-41.6814	-107.8929	-202.7133	-305.5021	-323.2194	-318.8984	-254.5392	-167.6320	-75.1169	-22.7702	-10.1154	(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												454.7519	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												283.2473	
Water heating fuel used												879.7882	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)													
mechanical ventilation fans (SFP = 0.8680)												231.8063	(230a)
Total electricity for the above, kWh/year												231.8063	(231)
Electricity for lighting (calculated in Appendix L)												187.4834	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4318.0985	(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												-2564.2686	(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	454.7519	0.1565	71.1800 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	879.7882	0.1411	124.1699 (264)
Space and water heating			195.3499 (265)
Pumps, fans and electric keep-hot	231.8063	0.1387	32.1544 (267)
Energy for lighting	187.4834	0.1443	27.0597 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2474.1949	0.1348	-333.5330
PV Unit electricity exported	-1843.9036	0.1203	-221.8534
Total			-555.3865 (269)
Total CO2, kg/year			-300.8225 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-3.4400 (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	454.7519	1.5794	718.2466 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.7882	1.5219	1338.9338 (278)
Space and water heating			2057.1804 (279)

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Pumps, fans and electric keep-hot	231.8063	1.5128	350.6766 (281)
Energy for lighting	187.4834	1.5338	287.5684 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2474.1949	1.4982	-3706.9590
PV Unit electricity exported	-1843.9036	0.4414	-813.8629
Total			-4520.8219 (283)
Total Primary energy kWh/year			-1825.3965 (286)
Dwelling Primary energy Rate (DPER)			-20.8500 (287)

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

 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.9000 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1370 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3870 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3870 (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	0.4935	0.4838	0.4741	0.4258	0.4161	0.3677	0.3677	0.3580	0.3870	0.4161	0.4354	0.4548 (22b)
Effective ac	0.6218	0.6170	0.6124	0.5906	0.5866	0.5676	0.5676	0.5641	0.5749	0.5866	0.5948	0.6034 (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
TER Semi-glazed door			1.7000	1.0000	1.7000		(26a)
TER Opening Type (Uw = 1.20)			16.3400	1.1450	18.7099		(27)
Ground Floor			43.7800	0.1300	5.6914		(28a)
R-Wall	142.0000	18.0400	123.9600	0.1800	22.3128		(29a)
Cold roof	43.7800		43.7800	0.1100	4.8158		(30)
Total net area of external elements Aum(A, m ²)			229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	53.2299	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0500	0.6575
E3 Sill	12.3000	0.0500	0.6150
E4 Jamb	25.0000	0.0500	1.2500
E5 Ground floor (normal)	28.4000	0.1600	4.5440
E6 Intermediate floor within a dwelling	28.4000	0.0000	0.0000

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[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North			5.7900	10.6334		0.6300	0.7000	0.7700		18.8158 (74)		
East			1.8900	19.6403		0.6300	0.7000	0.7700		11.3444 (76)		
South			8.6600	46.7521		0.6300	0.7000	0.7700		123.7344 (78)		
Solar gains	153.8946	260.7950	355.7823	443.1935	501.5515	500.9808	481.6684	437.1367	385.6207	287.7077	184.0243	131.9328 (83)
Total gains	721.2333	840.9200	912.0451	979.7630	1011.1168	989.2482	951.3979	907.8906	870.5663	792.2645	719.2689	687.5632 (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	25.2159	25.2953	25.3737	25.7485	25.8198	26.1573	26.1573	26.2207	26.0263	25.8198	25.6759	25.5271
alpha	2.6811	2.6864	2.6916	2.7166	2.7213	2.7438	2.7438	2.7480	2.7351	2.7213	2.7117	2.7018
util living area	0.9475	0.9218	0.8873	0.8217	0.7225	0.5800	0.4480	0.4818	0.6632	0.8386	0.9224	0.9530 (86)
MIT	18.6207	18.9597	19.4046	19.9763	20.4553	20.7932	20.9256	20.9073	20.6822	20.0673	19.2634	18.5740 (87)
Th 2	19.8869	19.8900	19.8930	19.9073	19.9100	19.9225	19.9225	19.9248	19.9176	19.9100	19.9045	19.8989 (88)
util rest of house	0.9392	0.9098	0.8695	0.7926	0.6750	0.5060	0.3509	0.3849	0.5947	0.8062	0.9085	0.9455 (89)
MIT 2	17.1440	17.5694	18.1253	18.8325	19.3952	19.7660	19.8833	19.8727	19.6582	18.9583	17.9666	17.0924 (90)
Living area fraction	flA = Living area / (4) =											
MIT	17.7103	18.1026	18.6159	19.2712	19.8017	20.1600	20.2830	20.2695	20.0509	19.3836	18.4639	17.6606 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.7103	18.1026	18.6159	19.2712	19.8017	20.1600	20.2830	20.2695	20.0509	19.3836	18.4639	17.6606 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9172	0.8849	0.8443	0.7730	0.6698	0.5233	0.3847	0.4174	0.6039	0.7878	0.8848	0.9248 (94)
Useful gains	661.5309	744.1267	770.0561	757.3544	677.2418	517.6873	366.0055	378.9869	525.7029	624.1285	636.4300	635.8391 (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	1457.9002	1430.8096	1308.9844	1104.1789	860.1759	582.6960	385.9887	404.5475	626.8078	932.5718	1213.2932	1445.5283 (97)
Space heating kWh	592.4988	461.4509	400.9627	249.7136	136.1030	0.0000	0.0000	0.0000	0.0000	229.4818	415.3415	602.4088 (98a)
Space heating requirement - total per year (kWh/year)												3087.9610
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	592.4988	461.4509	400.9627	249.7136	136.1030	0.0000	0.0000	0.0000	0.0000	229.4818	415.3415	602.4088 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3087.9610
Space heating per m2												(98c) / (4) = 35.2668 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	592.4988	461.4509	400.9627	249.7136	136.1030	0.0000	0.0000	0.0000	0.0000	229.4818	415.3415	602.4088 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	641.9272	499.9468	434.4124	270.5456	147.4572	0.0000	0.0000	0.0000	0.0000	248.6260	449.9908	652.6639 (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	234.2871	207.1014	220.0663	193.9224	188.2036	169.8535	167.9662	174.5795	176.4022	196.3522	208.3012	231.8150 (64)
Efficiency of water heater												
(217)m	86.0499	85.8023	85.3875	84.6279	83.3450	79.8000	79.8000	79.8000	79.8000	84.4103	85.5763	79.8000 (216)
Fuel for water heating, kWh/month	272.2689	241.3704	257.7266	229.1471	225.8126	212.8490	210.4839	218.7713	221.0554	232.6163	243.4099	269.2343 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.9655	20.0282	18.0332	13.2119	10.2052	8.3378	9.3096	12.1009	15.7179	20.6227	23.2933	25.6593 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-40.5221	-56.9062	-81.4828	-91.2485	-98.0762	-91.4124	-90.2565	-85.3430	-76.6507	-64.8685	-44.4597	-35.0577	(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	-23.5804	-49.5249	-98.2950	-147.4414	-194.7834	-195.6676	-193.3892	-163.8432	-120.2098	-70.7915	-31.4704	-18.6551	(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													3345.5699	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													79.8000	
Water heating fuel used													2834.7458	(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)													201.4855	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2163.9362	(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													4303.8650	(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	3345.5699	0.2100	702.5697 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2834.7458	0.2100	595.2966 (264)
Space and water heating			1297.8663 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	201.4855	0.1443	29.0806 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-856.2843	0.1347	-115.3193
PV Unit electricity exported	-1307.6519	0.1259	-164.6746
Total			-279.9938 (269)
Total CO2, kg/year			1058.8823 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0900 (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	3345.5699	1.1300	3780.4940 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2834.7458	1.1300	3203.2627 (278)
Space and water heating			6983.7567 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	201.4855	1.5338	309.0452 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-856.2843	1.4977	-1282.4890
PV Unit electricity exported	-1307.6519	0.4623	-604.4707
Total			-1886.9597 (283)
Total Primary energy kWh/year			5535.9430 (286)
Target Primary Energy Rate (TPER)			63.2200 (287)

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1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.9000 (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	3 * 10 =	30.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	30.0000 / (5) = 0.1370 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50		2.0000 (17)										
Infiltration rate		0.2370 (18)										
Number of sides sheltered		0 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2370 (21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3022	0.2963	0.2904	0.2608	0.2548	0.2252	0.2252	0.2193	0.2370	0.2548	0.2667	0.2785 (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	0.5457	0.5439	0.5422	0.5340	0.5325	0.5254	0.5254	0.5240	0.5281	0.5325	0.5356	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					
Windows (Uw = 1.20)			16.3400	1.1450	18.7099		(27)					
Half Glazed Door			1.7000	1.2000	2.0400		(26a)					
Ground Floor			43.7800	0.1200	5.2536	110.0000	4815.8000 (28a)					
R-Wall	142.0000	18.0400	123.9600	0.1400	17.3544	17.0000	2107.3200 (29a)					
Cold roof	43.7800		43.7800	0.0900	3.9402	9.0000	394.0200 (30)					
Total net area of external elements Aum(A, m2)			229.5600				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 47.2981		(33)					
Internal Wall 1			152.1800			9.0000	1369.6200 (32c)					
Internal Floor 1			43.7800			18.0000	788.0400 (32d)					
Internal Ceiling 1			43.7800			9.0000	394.0200 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9868.8200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							112.7092 (35)					
List of Thermal Bridges												
E1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				13.1500	0.0140	0.1841						
E3 Sill				12.3000	0.0460	0.5658						
E4 Jamb				25.0000	0.0050	0.1250						
E5 Ground floor (normal)				28.4000	0.0640	1.8176						
E6 Intermediate floor within a dwelling				28.4000	0.0490	1.3916						
E10 Eaves (insulation at ceiling level)				28.4000	0.0520	1.4768						
E16 Corner (normal)				25.0000	0.0420	1.0500						
E17 Corner (inverted - internal area greater than external area)				5.0000	0.0790	0.3950						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0059 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 54.3040 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.4178	Feb 39.2897	Mar 39.1641	Apr 38.5743	May 38.4639	Jun 37.9502	Jul 37.9502	Aug 37.8551	Sep 38.1481	Oct 38.4639	Nov 38.6872	Dec 38.9206 (38)
Heat transfer coeff	93.7219	93.5937	93.4682	92.8783	92.7680	92.2542	92.2542	92.1591	92.4521	92.7680	92.9912	93.2246 (39)
Average = Sum(39)m / 12 =												92.8778
HLP	Jan 1.0704	Feb 1.0689	Mar 1.0675	Apr 1.0607	May 1.0595	Jun 1.0536	Jul 1.0536	Aug 1.0525	Sep 1.0559	Oct 1.0595	Nov 1.0620	Dec 1.0647 (40)
HLP (average)												1.0607
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5908 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	29.2190	28.7850	28.1740	27.0472	26.2036	25.2680	24.7627	25.3695	26.0302	27.0313	28.1812	29.1202 (42b)
Hot water usage for other uses	41.1627	39.6658	38.1690	36.6722	35.1754	33.6785	33.6785	35.1754	36.6722	38.1690	39.6658	41.1627 (42c)
Average daily hot water use (litres/day)												64.5112 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	70.3817	68.4509	66.3430	63.7194	61.3789	58.9466	58.4413	60.5449	62.7024	65.2003	67.8470	70.2829 (44)
Energy content (annual)	111.4673	97.4731	101.9667	87.2287	82.6278	72.4817	70.6797	74.9672	77.3184	88.4762	96.6605	110.0460 (45)
Distribution loss (46) _m = 0.15 x (45) _m												Total = Sum(45) _m = 1071.3934
Water storage loss:												0.0000 (46)
Total storage loss												0.0000 (56)
If cylinder contains dedicated solar storage												0.0000 (57)
Primary loss												0.0000 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month	94.7472	82.8522	86.6717	74.1444	70.2337	61.6095	60.0777	63.7222	65.7206	75.2047	82.1615	93.5391 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h	94.7472	82.8522	86.6717	74.1444	70.2337	61.6095	60.0777	63.7222	65.7206	75.2047	82.1615	93.5391 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64) _m = 910.6844 (64)
Electric shower(s)	54.1839	48.2783	52.7181	50.3082	51.2522	48.8896	50.5193	51.2522	50.3082	52.7181	51.7268	54.1839 (64a)
Heat gains from water heating, kWh/month	37.2328	32.7826	34.8474	31.1132	30.3715	27.6248	27.6493	28.7436	29.0072	31.9807	33.4721	36.9308 (65)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) _m = 616.3388 (64a)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66) _m	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414	129.5414 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.1532	133.0267	120.1532	124.1583	120.1532	124.1583	120.1532	120.1532	124.1583	120.1532	124.1583	120.1532 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.5165	236.9500	230.8175	217.7623	201.2823	185.7935	175.4460	173.0125	179.1449	192.2002	208.6801	224.1690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541	35.9541 (69)
Pumps, fans												0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331 (71)
Water heating gains (Table 5)	50.0441	48.7837	46.8380	43.2127	40.8219	38.3677	37.1630	38.6339	40.2878	42.9848	46.4890	49.6381 (72)
Total internal gains	466.5761	480.6228	459.6711	446.9957	424.1198	410.1819	394.6246	393.6619	405.4534	417.2006	441.1898	455.8227 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
North	5.7900	10.6334	0.6300	0.7000	0.7700	18.8158 (74)						
East	1.8900	19.6403	0.6300	0.7000	0.7700	11.3444 (76)						
South	8.6600	46.7521	0.6300	0.7000	0.7700	123.7344 (78)						
Solar gains	153.8946	260.7950	355.7823	443.1935	501.5515	500.9808	481.6684	437.1367	385.6207	287.7077	184.0243	131.9328 (83)
Total gains	620.4707	741.4178	815.4534	890.1891	925.6713	911.1628	876.2930	830.7986	791.0741	704.9083	625.2141	587.7554 (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, n _{11,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.2497	29.2898	29.3291	29.5154	29.5505	29.7151	29.7151	29.7457	29.6515	29.5505	29.4795	29.4057
alpha	2.9500	2.9527	2.9553	2.9677	2.9700	2.9810	2.9810	2.9830	2.9768	2.9700	2.9653	2.9604

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util living area	0.9596	0.9334	0.8975	0.8275	0.7212	0.5719	0.4369	0.4742	0.6633	0.8511	0.9365	0.9650 (86)
MIT	18.8467	19.1898	19.6144	20.1374	20.5651	20.8452	20.9485	20.9331	20.7475	20.1870	19.4257	18.7776 (87)
Th 2	20.0251	20.0263	20.0275	20.0330	20.0341	20.0389	20.0389	20.0398	20.0370	20.0341	20.0320	20.0298 (88)
util rest of house	0.9534	0.9235	0.8821	0.8009	0.6774	0.5046	0.3507	0.3872	0.6005	0.8225	0.9254	0.9595 (89)
MIT 2	18.0661	18.4024	18.8159	19.3179	19.7084	19.9452	20.0166	20.0091	19.8722	19.3758	18.6426	18.0014 (90)
Living area fraction									fLA = Living area / (4) =			0.3835 (91)
MIT	18.3655	18.7044	19.1222	19.6322	20.0370	20.2903	20.3740	20.3635	20.2079	19.6869	18.9429	18.2991 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3655	18.7044	19.1222	19.6322	20.0370	20.2903	20.3740	20.3635	20.2079	19.6869	18.9429	18.2991 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9396	0.9070	0.8650	0.7886	0.6775	0.5230	0.3816	0.4176	0.6124	0.8106	0.9098	0.9468 (94)
Useful gains	582.9988	672.4409	705.3685	701.9764	627.1473	476.5674	334.4273	346.9358	484.4496	571.4103	568.8052	556.4682 (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	1318.2406	1292.0022	1179.7691	996.7898	773.4052	524.9558	348.1701	365.2691	564.6848	842.9710	1101.2885	1314.3823 (97)
Space heating kWh	547.0199	416.3452	352.9540	212.2657	108.8159	0.0000	0.0000	0.0000	0.0000	202.0412	383.3879	563.8881 (98a)
Space heating requirement - total per year (kWh/year)												2786.7179
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	547.0199	416.3452	352.9540	212.2657	108.8159	0.0000	0.0000	0.0000	0.0000	202.0412	383.3879	563.8881 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2786.7179
Space heating per m2										(98c) / (4) =		31.8264 (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	867.1896	682.6812	700.4090	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8049	0.8642	0.8426	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	697.9950	589.9685	590.1973	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1016.6988	978.3237	927.5184	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	229.4667	288.9362	250.9669	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	57.3667	72.2341	62.7417	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												192.3425 (107)
Energy for space heating												31.8264 (99)
Energy for space cooling												2.1967 (108)
Total												34.0231 (109)
Fabric Energy Efficiency (DFEE)												34.0 (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	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.9000 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
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Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (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) =	30.0000	Air changes per hour / (5) =	0.1370 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50				5.0000 (17)
Infiltration rate				0.3870 (18)
Number of sides sheltered				0 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3870 (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	0.4935	0.4838	0.4741	0.4258	0.4161	0.3677	0.3677	0.3580	0.3870	0.4161	0.4354	0.4548 (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	0.6218	0.6170	0.6124	0.5906	0.5866	0.5676	0.5676	0.5641	0.5749	0.5866	0.5948	0.6034 (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			1.7000	1.0000	1.7000		(26a)
TER Opening Type (Uw = 1.20)			16.3400	1.1450	18.7099		(27)
Ground Floor			43.7800	0.1300	5.6914		(28a)
R-Wall	142.0000	18.0400	123.9600	0.1800	22.3128		(29a)
Cold roof	43.7800		43.7800	0.1100	4.8158		(30)
Total net area of external elements Aum(A, m2)			229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)					53.2299		(32)
					(26)...(30) + (32) =		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0500	0.6575
E3 Sill	12.3000	0.0500	0.6150
E4 Jamb	25.0000	0.0500	1.2500
E5 Ground floor (normal)	28.4000	0.1600	4.5440
E6 Intermediate floor within a dwelling	28.4000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	28.4000	0.0600	1.7040
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5705 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 63.8004 (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	44.9144	44.5729	44.2381	42.6656	42.3714	41.0017	41.0017	40.7481	41.5293	42.3714	42.9665	43.5888 (38)
Average = Sum(39)m / 12 =	108.7149	108.3733	108.0385	106.4660	106.1718	104.8022	104.8022	104.5485	105.3297	106.1718	106.7670	107.3892 (39)
												106.4646

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2416	1.2377	1.2339	1.2159	1.2126	1.1969	1.1969	1.1940	1.2029	1.2126	1.2194	1.2265 (40)
HLP (average)												1.2159
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42)
Hot water usage for baths	29.2190	28.7850	28.1740	27.0472	26.2036	25.2680	24.7627	25.3695	26.0302	27.0313	28.1812	29.1202 (42b)
Hot water usage for other uses	41.1627	39.6658	38.1690	36.6722	35.1754	33.6785	33.6785	35.1754	36.6722	38.1690	39.6658	41.1627 (42c)
Average daily hot water use (litres/day)												64.5112 (43)
Daily hot water use	70.3817	68.4509	66.3430	63.7194	61.3789	58.9466	58.4413	60.5449	62.7024	65.2003	67.8470	70.2829 (44)
Energy conte	111.4673	97.4731	101.9667	87.2287	82.6278	72.4817	70.6797	74.9672	77.3184	88.4762	96.6605	110.0460 (45)
Energy content (annual)												Total = Sum(45)m = 1071.3934
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)

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Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1479.0462	1447.5507	1320.0605	1109.2111	861.1851	582.3100	385.6049	404.0247	626.2269	935.3760	1225.0655	1467.0835 (97)
Space heating kWh	665.9916	518.5397	451.7473	282.3655	155.6287	0.0000	0.0000	0.0000	0.0000	263.3906	470.6538	677.1341 (98a)
Space heating requirement - total per year (kWh/year)												3485.4515
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	665.9916	518.5397	451.7473	282.3655	155.6287	0.0000	0.0000	0.0000	0.0000	263.3906	470.6538	677.1341 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3485.4515
Space heating per m2												(98c) / (4) = 39.8064 (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	985.1404	775.5361	794.5689	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7443	0.8113	0.7871	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	733.2787	629.2293	625.3809	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1016.6988	978.3237	927.5184	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	204.0624	259.7262	224.7903	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	51.0156	64.9316	56.1976	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												172.1447 (107)
Energy for space heating												39.8064 (99)
Energy for space cooling												1.9660 (108)
Total												41.7725 (109)
Fabric Energy Efficiency (TFEE)												41.8 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 218.9000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.0000 (17)
Infiltration rate	0.1000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1000 (21)

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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												
	0.1275	0.1250	0.1225	0.1100	0.1075	0.0950	0.0950	0.0925	0.1000	0.1075	0.1125	0.1175 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												82.8000 (23c)
Effective ac	0.2135	0.2110	0.2085	0.1960	0.1935	0.1810	0.1810	0.1785	0.1860	0.1935	0.1985	0.2035 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			16.3400	1.1450	18.7099		(27)
Half Glazed Door			1.7000	1.2000	2.0400		(26a)
Ground Floor			43.7800	0.1200	5.2536	110.0000	4815.8000 (28a)
R-Wall	142.0000	18.0400	123.9600	0.1400	17.3544	17.0000	2107.3200 (29a)
Cold roof	43.7800		43.7800	0.0900	3.9402	9.0000	394.0200 (30)
Total net area of external elements Aum(A, m2)			229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 47.2981		(33)
Internal Wall 1			152.1800			9.0000	1369.6200 (32c)
Internal Floor 1			43.7800			18.0000	788.0400 (32d)
Internal Ceiling 1			43.7800			9.0000	394.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9868.8200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0140	0.1841
E3 Sill	12.3000	0.0460	0.5658
E4 Jamb	25.0000	0.0050	0.1250
E5 Ground floor (normal)	28.4000	0.0640	1.8176
E6 Intermediate floor within a dwelling	28.4000	0.0490	1.3916
E10 Eaves (insulation at ceiling level)	28.4000	0.0520	1.4768
E16 Corner (normal)	25.0000	0.0420	1.0500
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0790	0.3950
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0059 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 54.3040 (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	15.4226	15.2420	15.0614	14.1585	13.9779	13.0749	13.0749	12.8943	13.4361	13.9779	14.3390	14.7002 (38)
Heat transfer coeff	69.7266	69.5460	69.3654	68.4625	68.2819	67.3789	67.3789	67.1983	67.7401	68.2819	68.6431	69.0043 (39)
Average = Sum(39)m / 12 =												68.4173
HLP	0.7963	0.7943	0.7922	0.7819	0.7798	0.7695	0.7695	0.7675	0.7736	0.7798	0.7840	0.7881 (40)
HLP (average)												0.7814
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5908 (42)
Hot water usage for mixer showers	67.6594	66.6426	65.1610	62.3261	60.2340	57.9009	56.5748	58.0453	59.6571	62.1621	65.0579	67.4002 (42a)
Hot water usage for baths	29.2190	28.7850	28.1740	27.0472	26.2036	25.2680	24.7627	25.3695	26.0302	27.0313	28.1812	29.1202 (42b)
Hot water usage for other uses	41.1627	39.6658	38.1690	36.6722	35.1754	33.6785	33.6785	35.1754	36.6722	38.1690	39.6658	41.1627 (42c)
Average daily hot water use (litres/day)												126.8909 (43)
Daily hot water use	138.0411	135.0935	131.5039	126.0455	121.6129	116.8475	115.0161	118.5902	122.3596	127.3624	132.9050	137.6830 (44)
Energy conte	218.6233	192.3713	202.1166	172.5500	163.7144	143.6776	139.1020	146.8394	150.8816	172.8296	189.3475	215.5784 (45)
Energy content (annual)												Total = Sum(45)m = 2107.6317
Distribution loss (46)m = 0.15 x (45)m	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368 (46)
Water storage loss:												170.0000 (47)
Store volume												1.9500 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0530 (55)
Enter (49) or (54) in (55)												
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	(64)	
	Total per year (kWh/year) = Sum(64)m = 2491.9767 (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	72.6922	63.9635	67.2038	57.3729	54.4350	47.7728	46.2514	48.8241	50.1681	57.4658	62.9580	71.6798	(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	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5402	23.5728	19.1707	14.5134	10.8490	9.1592	9.8968	12.8642	17.2663	21.9236	25.5880	27.2779	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.0246	353.6567	344.5038	325.0183	300.4214	277.3037	261.8597	258.2275	267.3805	286.8660	311.4629	334.5806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	(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)	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	(71)
Water heating gains (Table 5)	97.7046	95.1837	90.3277	79.6845	73.1654	66.3511	62.1659	65.6238	69.6780	77.2390	87.4417	96.3438	(72)
Total internal gains	579.2218	577.3656	558.9545	524.1686	489.3880	457.7664	438.8747	441.6679	459.2771	490.9809	529.4450	563.1546	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W	
North	5.7900	10.6334	0.6300	0.7000	0.7700	18.8158	(74)
East	1.8900	19.6403	0.6300	0.7000	0.7700	11.3444	(76)
South	8.6600	46.7521	0.6300	0.7000	0.7700	123.7344	(78)

Solar gains	153.8946	260.7950	355.7823	443.1935	501.5515	500.9808	481.6684	437.1367	385.6207	287.7077	184.0243	131.9328	(83)
Total gains	733.1164	838.1606	914.7368	967.3621	990.9395	958.7472	920.5431	878.8046	844.8978	778.6886	713.4693	695.0874	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	39.3155	39.4176	39.5202	40.0415	40.1474	40.6854	40.6854	40.7947	40.4685	40.1474	39.9361	39.7271	
alpha	3.6210	3.6278	3.6347	3.6694	3.6765	3.7124	3.7124	3.7196	3.6979	3.6765	3.6624	3.6485	
util living area	0.9214	0.8809	0.8198	0.7212	0.5896	0.4367	0.3188	0.3470	0.5237	0.7485	0.8828	0.9317	(86)
Living	20.0196	20.2162	20.4459	20.6753	20.8226	20.8938	20.9114	20.9094	20.8706	20.6817	20.3193	19.9758	
Non living	19.1038	19.3475	19.6285	19.9075	20.0739	20.1550	20.1699	20.1705	20.1306	19.9225	19.4866	19.0554	
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	20.4984	20.2162	20.4459	20.6753	20.8226	20.8938	20.9114	20.9094	20.8706	20.6817	20.3193	20.1191	(87)
Th 2	20.2565	20.2583	20.2601	20.2691	20.2708	20.2798	20.2798	20.2816	20.2762	20.2708	20.2673	20.2637	(88)
util rest of house	0.9119	0.8675	0.8006	0.6936	0.5525	0.3911	0.2678	0.2945	0.4759	0.7172	0.8674	0.9233	(89)
MIT 2	19.7970	19.3475	19.6285	19.9075	20.0739	20.1550	20.1699	20.1705	20.1306	19.9225	19.4866	19.2731	(90)
Living area fraction									fLA = Living area / (4) =			0.3835	(91)
MIT	20.0660	19.6806	19.9420	20.2020	20.3611	20.4383	20.4543	20.4539	20.4144	20.2136	19.8060	19.5976	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0660	19.6806	19.9420	20.2020	20.3611	20.4383	20.4543	20.4539	20.4144	20.2136	19.8060	19.5976	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	666.5620	717.4087	724.1748	668.3691	552.1351	384.7552	257.9939	269.9941	409.9720	556.4433	611.1388	635.7210	(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	1099.3099	1027.9346	932.4107	773.7623	591.3943	393.3796	259.6977	272.4138	427.7382	656.4377	872.1773	1062.4973	(97)
Space heating kWh	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	(98a)
Space heating requirement - total per year (kWh/year)	1370.5225												
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh																	0.0000
Space heating requirement after solar contribution - total per year (kWh/year)	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	1370.5225				(98c)
Space heating per m2										(98c) / (4) =							15.6524 (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 %)																	329.6631 (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	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	(98)
Space heating efficiency (main heating system 1)	329.6631	329.6631	329.6631	329.6631	329.6631	0.0000	0.0000	0.0000	0.0000	329.6631	329.6631	329.6631	(210)
Space heating fuel (main heating system)	97.6647	63.2990	46.9957	23.0184	8.8602	0.0000	0.0000	0.0000	0.0000	22.5672	57.0120	96.3170	(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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	(64)
Efficiency of water heater (217)m	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	(216)
Fuel for water heating, kWh/month	88.7091	78.3257	82.8815	72.0713	69.3236	61.8779	60.6343	63.3660	64.4213	72.5418	78.0016	87.6341	(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	19.6877	17.7824	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	(231)
Lighting	23.2305	18.6364	16.7800	12.2937	9.4960	7.7583	8.6626	11.2600	14.6256	19.1896	21.6746	23.8761	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-111.1556	-166.8543	-247.0470	-273.4243	-283.2613	-256.0649	-252.7304	-244.8958	-223.5258	-191.6080	-125.5103	-94.5078	(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	-14.0607	-42.0957	-108.8186	-203.5058	-305.9456	-323.2194	-318.8984	-254.5392	-167.6320	-75.5067	-23.0142	-10.2768	(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													415.7343 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													283.2473
Water heating fuel used													879.7882 (219)
Space cooling fuel													0.0000 (221)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)													
mechanical ventilation fans (SFP = 0.8680)													231.8063 (230a)
Total electricity for the above, kWh/year													231.8063 (231)
Electricity for lighting (calculated in Appendix L)													187.4834 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4318.0985 (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													-2603.2862 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	415.7343	16.4900	68.5546	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	879.7882	16.4900	145.0771	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	231.8063	16.4900	38.2249	(249)

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Energy for lighting	187.4834	16.4900	30.9160 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2470.5855	16.4900	-407.3995
PV Unit electricity exported	-1847.5130	5.5900	-103.2760
Total			-510.6755 (252)
Total energy cost			-227.9030 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.6189 (257)
SAP value		110.0328
SAP rating (Section 12)		110 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	415.7343	0.1565	65.0763 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	879.7882	0.1411	124.1699 (264)
Space and water heating			189.2462 (265)
Pumps, fans and electric keep-hot	231.8063	0.1387	32.1544 (267)
Energy for lighting	187.4834	0.1443	27.0597 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2470.5855	0.1348	-332.9983
PV Unit electricity exported	-1847.5130	0.1204	-222.4461
Total			-555.4444 (269)
Total CO2, kg/year			-306.9841 (272)
CO2 emissions per m2			-3.5100 (273)
EI value			103.1032
EI rating			103 (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	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	218.9000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.0000 (17)
Infiltration rate	0.1000 (18)
Number of sides sheltered	0 (19)

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Shelter factor													(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.1000 (21)
Wind speed	Jan 6.5000	Feb 6.1000	Mar 6.0000	Apr 5.2000	May 5.2000	Jun 4.7000	Jul 4.6000	Aug 4.6000	Sep 5.0000	Oct 5.9000	Nov 6.0000	Dec 6.4000		(22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000		(22a)
Adj infiltr rate	0.1625	0.1525	0.1500	0.1300	0.1300	0.1175	0.1150	0.1150	0.1250	0.1475	0.1500	0.1600		(22b)
Balanced mechanical ventilation with heat recovery														
If mechanical ventilation														0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)														0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =														82.8000 (23c)
Effective ac	0.2485	0.2385	0.2360	0.2160	0.2160	0.2035	0.2010	0.2010	0.2110	0.2335	0.2360	0.2460		(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			16.3400	1.1450	18.7099			(27)
Half Glazed Door			1.7000	1.2000	2.0400			(26a)
Ground Floor			43.7800	0.1200	5.2536	110.0000	4815.8000	(28a)
R-Wall	142.0000	18.0400	123.9600	0.1400	17.3544	17.0000	2107.3200	(29a)
Cold roof	43.7800		43.7800	0.0900	3.9402	9.0000	394.0200	(30)
Total net area of external elements Aum(A, m2)			229.5600					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.2981		(33)
Internal Wall 1			152.1800			9.0000	1369.6200	(32c)
Internal Floor 1			43.7800			18.0000	788.0400	(32d)
Internal Ceiling 1			43.7800			9.0000	394.0200	(32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	9868.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	13.1500	0.0140	0.1841	
E3 Sill	12.3000	0.0460	0.5658	
E4 Jamb	25.0000	0.0050	0.1250	
E5 Ground floor (normal)	28.4000	0.0640	1.8176	
E6 Intermediate floor within a dwelling	28.4000	0.0490	1.3916	
E10 Eaves (insulation at ceiling level)	28.4000	0.0520	1.4768	
E16 Corner (normal)	25.0000	0.0420	1.0500	
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0790	0.3950	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0059	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	54.3040 (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	17.9509	17.2285	17.0479	15.6032	15.6032	14.7002	14.5196	14.5196	15.2420	16.8673	17.0479	17.7703	(38)
Average = Sum(39)m / 12 =	72.2549	71.5325	71.3520	69.9072	69.9072	69.0043	68.8237	68.8237	69.5460	71.1714	71.3520	72.0743	(39)
HLP	0.8252	0.8170	0.8149	0.7984	0.7984	0.7881	0.7860	0.7860	0.7943	0.8128	0.8149	0.8231	(40)
HLP (average)												0.8049	
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	67.6594	66.6426	65.1610	62.3261	60.2340	57.9009	56.5748	58.0453	59.6571	62.1621	65.0579	67.4002	(42a)
Hot water usage for baths	29.2190	28.7850	28.1740	27.0472	26.2036	25.2680	24.7627	25.3695	26.0302	27.0313	28.1812	29.1202	(42b)
Hot water usage for other uses	41.1627	39.6658	38.1690	36.6722	35.1754	33.6785	33.6785	35.1754	36.6722	38.1690	39.6658	41.1627	(42c)
Average daily hot water use (litres/day)	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368	(46)
Daily hot water use	138.0411	135.0935	131.5039	126.0455	121.6129	116.8475	115.0161	118.5902	122.3596	127.3624	132.9050	137.6830	(44)
Energy conte	218.6233	192.3713	202.1166	172.5500	163.7144	143.6776	139.1020	146.8394	150.8816	172.8296	189.3475	215.5784	(45)
Energy content (annual)										Total = Sum(45)m =		2107.6317	
Distribution loss (46)m = 0.15 x (45)m	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368	(46)
Water storage loss:													
Store volume													170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0530 (55)
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430	(56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430	(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)

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month														
	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	2491.9767	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h														
	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	2491.9767	(64)
													Total per year (kWh/year) = Sum(64)m =	
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 =	
Heat gains from water heating, kWh/month	72.6922	63.9635	67.2038	57.3729	54.4350	47.7728	46.2514	48.8241	50.1681	57.4658	62.9580	71.6798	71.6798	(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	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	26.5402	23.5728	19.1707	14.5134	10.8490	9.1592	9.8968	12.8642	17.2663	21.9236	25.5880	27.2779	27.2779	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	350.0246	353.6567	344.5038	325.0183	300.4214	277.3037	261.8597	258.2275	267.3805	286.8660	311.4629	334.5806	334.5806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	(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	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)														
	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	(71)
Water heating gains (Table 5)														
	97.7046	95.1837	90.3277	79.6845	73.1654	66.3511	62.1659	65.6238	69.6780	77.2390	87.4417	96.3438	96.3438	(72)
Total internal gains	579.2218	577.3656	558.9545	524.1686	489.3880	457.7664	438.8747	441.6679	459.2771	490.9809	529.4450	563.1546	563.1546	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North		5.7900	13.8487	0.6300	0.7000	0.7700	24.5053 (74)							
East		1.8900	25.8938	0.6300	0.7000	0.7700	14.9565 (76)							
South		8.6600	58.0763	0.6300	0.7000	0.7700	153.7053 (78)							
Solar gains	193.1671	279.7868	384.4244	490.0876	541.2838	566.4794	497.6440	480.9044	426.2955	314.4329	223.6451	164.0225	164.0225	(83)
Total gains	772.3889	857.1524	943.3789	1014.2562	1030.6718	1024.2457	936.5187	922.5723	885.5726	805.4138	753.0901	727.1771	727.1771	(84)

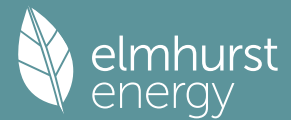
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.9398	38.3230	38.4200	39.2140	39.2140	39.7271	39.8313	39.8313	39.4176	38.5174	38.4200	38.0349	
alpha	3.5293	3.5549	3.5613	3.6143	3.6143	3.6485	3.6554	3.6554	3.6278	3.5678	3.5613	3.5357	
util living area	0.8875	0.8525	0.7916	0.7037	0.5856	0.4492	0.3750	0.3666	0.4941	0.6990	0.8279	0.8971	0.8971 (86)
Living	20.2040	20.3302	20.5069	20.6857	20.8168	20.8861	20.9035	20.9048	20.8758	20.7336	20.4902	20.1876	
Non living	19.3137	19.4719	19.6847	19.9056	20.0517	20.1311	20.1489	20.1500	20.1175	19.9549	19.6719	19.2964	
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	20.5928	20.3302	20.5069	20.6857	20.8168	20.8861	20.9035	20.9048	20.8758	20.7336	20.4902	20.3012 (87)	
Th 2	20.2315	20.2387	20.2404	20.2547	20.2547	20.2637	20.2655	20.2655	20.2583	20.2422	20.2404	20.2333 (88)	
util rest of house													
	0.8733	0.8353	0.7692	0.6751	0.5484	0.4053	0.3244	0.3149	0.4448	0.6610	0.8047	0.8835 (89)	
MIT 2	19.8656	19.4719	19.6847	19.9056	20.0517	20.1311	20.1489	20.1500	20.1175	19.9549	19.6719	19.4652 (90)	
Living area fraction													fLA = Living area / (4) =
MIT	20.1445	19.8011	20.0000	20.2048	20.3451	20.4206	20.4383	20.4395	20.4083	20.2536	19.9857	19.7859 (92)	
Temperature adjustment													
adjusted MIT	20.1445	19.8011	20.0000	20.2048	20.3451	20.4206	20.4383	20.4395	20.4083	20.2536	19.9857	19.7859 (93)	

8. Space heating requirement

Utilisation	0.8715	0.8245	0.7616	0.6731	0.5530	0.4148	0.3364	0.3273	0.4550	0.6616	0.7961	0.8746 (94)	
Useful gains	673.1548	706.6949	718.4756	682.6471	569.9718	424.8215	315.0807	301.9229	402.9249	532.8927	599.5500	635.9718 (95)	
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000 (96)	
Heat loss rate W													

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Space heating kWh	1014.7830	965.7660	899.0366	783.2940	611.3487	436.1516	319.2241	305.5418	417.8538	608.7685	783.8506	964.7768 (97)
Space heating requirement - total per year (kWh/year)	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1099.6337
Space heating per m2												(98c) / (4) = 12.5586 (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 %)												332.1673 (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	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309 (98)
Space heating efficiency (main heating system 1)	332.1673	332.1673	332.1673	332.1673	332.1673	0.0000	0.0000	0.0000	0.0000	332.1673	332.1673	332.1673 (210)
Space heating fuel (main heating system)	76.5191	52.4121	40.4427	21.8160	9.2678	0.0000	0.0000	0.0000	0.0000	16.9949	39.9487	73.6469 (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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (64)
Efficiency of water heater (217)m	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264 (216)
Fuel for water heating, kWh/month	88.6844	78.3038	82.8584	72.0512	69.3043	61.8607	60.6174	63.3483	64.4033	72.5215	77.9799	87.6097 (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	19.6877	17.7824	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.6877 (231)
Lighting	23.2305	18.6364	16.7800	12.2937	9.4960	7.7583	8.6626	11.2600	14.6256	19.1896	21.6746	23.8761 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-138.1617	-179.3012	-262.6167	-287.8165	-290.5135	-262.1412	-254.9987	-252.9325	-236.1321	-206.2706	-149.7231	-116.9687 (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	-23.6398	-51.7040	-132.5888	-249.8405	-352.5998	-398.0385	-341.1183	-305.2652	-207.0904	-94.4539	-36.1891	-17.0578 (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												331.0481 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												283.3264
Water heating fuel used												879.5428 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680) mechanical ventilation fans (SFP = 0.8680)												231.8063 (230a)
Total electricity for the above, kWh/year												231.8063 (231)
Electricity for lighting (calculated in Appendix L)												187.4834 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4847.1626 (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												-3217.2819 (238)

10a. Fuel costs - using BEDF prices (528)

Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
---------------	------------------	------------------

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Space heating - main system 1	331.0481	21.5100	71.2085 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.5428	21.5100	189.1897 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	231.8063	21.5100	49.8615 (249)
Energy for lighting	187.4834	21.5100	40.3277 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	21.5100	-567.3427
PV Unit electricity exported	-2209.5860	5.5900	-123.5159
Total			-690.8586 (252)
Total energy cost			-340.2712 (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	331.0481	0.1563	51.7373 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	879.5428	0.1411	124.1353 (264)
Space and water heating			175.8726 (265)
Pumps, fans and electric keep-hot	231.8063	0.1387	32.1544 (267)
Energy for lighting	187.4834	0.1443	27.0597 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	0.1355	-357.5197
PV Unit electricity exported	-2209.5860	0.1216	-268.6267
Total			-626.1464 (269)
Total CO2, kg/year			-391.0598 (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	331.0481	1.5786	522.5799 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.5428	1.5219	1338.5603 (278)
Space and water heating			1861.1402 (279)
Pumps, fans and electric keep-hot	231.8063	1.5128	350.6766 (281)
Energy for lighting	187.4834	1.5338	287.5684 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	1.5010	-3959.0579
PV Unit electricity exported	-2209.5860	0.4461	-985.7570
Total			-4944.8149 (283)
Total Primary energy kWh/year			-2445.4297 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 110
 Current environmental impact rating: A 103

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

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

Measures omitted - SAP change or cost saving too small:
 N Solar water heating + 0.6 -£ 20 -21 kg (5.3%)

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

Potential energy efficiency rating: A 110
 Potential environmental impact rating: A 103

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South West England):
 Electricity Current Potential Saving
 £351 £351 £0

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Space heating	£121	£121	£0
Water heating	£189	£189	£0
Lighting	£40	£40	£0
Generated (PV)	-£691	-£691	£0
Total cost of fuels	-£340	-£340	£0
Total cost of uses	-£341	-£341	£0
Delivered energy	-37 kWh/m ²	-37 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	-0.4 tonnes	-0.4 tonnes	0.0 tonnes
CO2 emissions per m ²	-4 kg/m ²	-4 kg/m ²	0 kg/m ²
Primary energy	-28 kWh/m ²	-28 kWh/m ²	0 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	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b)
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 218.9000 (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	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	2.0000 (17)											
Infiltration rate	0.1000 (18)											
Number of sides sheltered	0 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1000 (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	0.1275	0.1250	0.1225	0.1100	0.1075	0.0950	0.0950	0.0925	0.1000	0.1075	0.1125	0.1175 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												82.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2135	0.2110	0.2085	0.1960	0.1935	0.1810	0.1810	0.1785	0.1860	0.1935	0.1985	0.2035 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			16.3400	1.1450	18.7099		(27)
Half Glazed Door			1.7000	1.2000	2.0400		(26a)
Ground Floor			43.7800	0.1200	5.2536	110.0000	4815.8000 (28a)
R-Wall	142.0000	18.0400	123.9600	0.1400	17.3544	17.0000	2107.3200 (29a)
Cold roof	43.7800		43.7800	0.0900	3.9402	9.0000	394.0200 (30)
Total net area of external elements Aum(A, m ²)			229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.2981	(33)

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Internal Wall 1	152.1800	9.0000	1369.6200 (32c)
Internal Floor 1	43.7800	18.0000	788.0400 (32d)
Internal Ceiling 1	43.7800	9.0000	394.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9868.8200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0140	0.1841
E3 Sill	12.3000	0.0460	0.5658
E4 Jamb	25.0000	0.0050	0.1250
E5 Ground floor (normal)	28.4000	0.0640	1.8176
E6 Intermediate floor within a dwelling	28.4000	0.0490	1.3916
E10 Eaves (insulation at ceiling level)	28.4000	0.0520	1.4768
E16 Corner (normal)	25.0000	0.0420	1.0500
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0790	0.3950

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0059 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 54.3040 (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	15.4226	15.2420	15.0614	14.1585	13.9779	13.0749	13.0749	12.8943	13.4361	13.9779	14.3390	14.7002 (38)
Average = Sum(39)m / 12 =	69.7266	69.5460	69.3654	68.4625	68.2819	67.3789	67.3789	67.1983	67.7401	68.2819	68.6431	69.0043 (39)
												68.4173

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7963	0.7943	0.7922	0.7819	0.7798	0.7695	0.7695	0.7675	0.7736	0.7798	0.7840	0.7881 (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													2.5908 (42)
Hot water usage for mixer showers	67.6594	66.6426	65.1610	62.3261	60.2340	57.9009	56.5748	58.0453	59.6571	62.1621	65.0579	67.4002 (42a)	
Hot water usage for baths	29.2190	28.7850	28.1740	27.0472	26.2036	25.2680	24.7627	25.3695	26.0302	27.0313	28.1812	29.1202 (42b)	
Hot water usage for other uses	41.1627	39.6658	38.1690	36.6722	35.1754	33.6785	33.6785	35.1754	36.6722	38.1690	39.6658	41.1627 (42c)	
Average daily hot water use (litres/day)													126.8909 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	138.0411	135.0935	131.5039	126.0455	121.6129	116.8475	115.0161	118.5902	122.3596	127.3624	132.9050	137.6830 (44)
Energy content (annual)	218.6233	192.3713	202.1166	172.5500	163.7144	143.6776	139.1020	146.8394	150.8816	172.8296	189.3475	215.5784 (45)
Distribution loss (46)m = 0.15 x (45)m	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368 (46)

Water storage loss:
 Store volume 170.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.9500 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.0530 (55)
 Total storage loss

If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (64)
Total per year (kWh/year) = Sum(64)m =												2491.9767 (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	72.6922	63.9635	67.2038	57.3729	54.4350	47.7728	46.2514	48.8241	50.1681	57.4658	62.9580	71.6798 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5402	23.5728	19.1707	14.5134	10.8490	9.1592	9.8968	12.8642	17.2663	21.9236	25.5880	27.2779 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.0246	353.6567	344.5038	325.0183	300.4214	277.3037	261.8597	258.2275	267.3805	286.8660	311.4629	334.5806 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358 (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)

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Losses e.g. evaporation (negative values) (Table 5)	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	(71)
Water heating gains (Table 5)	97.7046	95.1837	90.3277	79.6845	73.1654	66.3511	62.1659	65.6238	69.6780	77.2390	87.4417	96.3438	(72)
Total internal gains	579.2218	577.3656	558.9545	524.1686	489.3880	457.7664	438.8747	441.6679	459.2771	490.9809	529.4450	563.1546	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	5.7900	10.6334	0.6300	0.7000	0.7700	18.8158	(74)
East	1.8900	19.6403	0.6300	0.7000	0.7700	11.3444	(76)
South	8.6600	46.7521	0.6300	0.7000	0.7700	123.7344	(78)

Solar gains	153.8946	260.7950	355.7823	443.1935	501.5515	500.9808	481.6684	437.1367	385.6207	287.7077	184.0243	131.9328	(83)
Total gains	733.1164	838.1606	914.7368	967.3621	990.9395	958.7472	920.5431	878.8046	844.8978	778.6886	713.4693	695.0874	(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, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	39.3155	39.4176	39.5202	40.0415	40.1474	40.6854	40.6854	40.7947	40.4685	40.1474	39.9361	39.7271		
alpha	3.6210	3.6278	3.6347	3.6694	3.6765	3.7124	3.7124	3.7196	3.6979	3.6765	3.6624	3.6485		
util living area	0.9214	0.8809	0.8198	0.7212	0.5896	0.4367	0.3188	0.3470	0.5237	0.7485	0.8828	0.9317	(86)	
Living	20.0196	20.2162	20.4459	20.6753	20.8226	20.8938	20.9114	20.9094	20.8706	20.6817	20.3193	19.9758		
Non living	19.1038	19.3475	19.6285	19.9075	20.0739	20.1550	20.1699	20.1705	20.1306	19.9225	19.4866	19.0554		
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	20.4984	20.2162	20.4459	20.6753	20.8226	20.8938	20.9114	20.9094	20.8706	20.6817	20.3193	20.1191	(87)	
Th 2	20.2565	20.2583	20.2601	20.2691	20.2708	20.2798	20.2798	20.2816	20.2762	20.2708	20.2673	20.2637	(88)	
util rest of house	0.9119	0.8675	0.8006	0.6936	0.5525	0.3911	0.2678	0.2945	0.4759	0.7172	0.8674	0.9233	(89)	
MIT 2	19.7970	19.3475	19.6285	19.9075	20.0739	20.1550	20.1699	20.1705	20.1306	19.9225	19.4866	19.2731	(90)	
Living area fraction	fLA = Living area / (4) =												0.3835	(91)
MIT	20.0660	19.6806	19.9420	20.2020	20.3611	20.4383	20.4543	20.4539	20.4144	20.2136	19.8060	19.5976	(92)	
Temperature adjustment													0.0000	
adjusted MIT	20.0660	19.6806	19.9420	20.2020	20.3611	20.4383	20.4543	20.4539	20.4144	20.2136	19.8060	19.5976	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	0.9092	0.8559	0.7917	0.6909	0.5572	0.4013	0.2803	0.3072	0.4852	0.7146	0.8566	0.9146	(94)		
Useful gains	666.5620	717.4087	724.1748	668.3691	552.1351	384.7552	257.9939	269.9941	409.9720	556.4433	611.1388	635.7210	(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	1099.3099	1027.9346	932.4107	773.7623	591.3943	393.3796	259.6977	272.4138	427.7382	656.4377	872.1773	1062.4973	(97)		
Space heating kWh	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	(98a)		
Space heating requirement - total per year (kWh/year)													1370.5225		
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	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	(98c)		
Space heating requirement after solar contribution - total per year (kWh/year)													1370.5225		
Space heating per m2													(98c) / (4) =	15.6524	(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 %)													329.6631	(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		
	321.9645	208.6735	154.9275	75.8831	29.2089	0.0000	0.0000	0.0000	0.0000	74.3959	187.9477	317.5216	(98)	
Space heating efficiency (main heating system 1)	329.6631	329.6631	329.6631	329.6631	329.6631	0.0000	0.0000	0.0000	0.0000	329.6631	329.6631	329.6631	(210)	
Space heating fuel (main heating system)	97.6647	63.2990	46.9957	23.0184	8.8602	0.0000	0.0000	0.0000	0.0000	22.5672	57.0120	96.3170	(211)	
Space heating efficiency (main heating system 2)														

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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	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	0.0000	(213)
Water heating 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	0.0000	(215)
Efficiency of water heater (217)m	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	283.2473	(64)
Fuel for water heating, kWh/month	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	283.2473	(216)
Space cooling fuel requirement (221)m	88.7091	78.3257	82.8815	72.0713	69.3236	61.8779	60.6343	63.3660	64.4213	72.5418	78.0016	87.6341	87.6341	(217)
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	0.0000	(221)
Lighting	19.6877	17.7824	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	(231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	23.2305	18.6364	16.7800	12.2937	9.4960	7.7583	8.6626	11.2600	14.6256	19.1896	21.6746	23.8761	23.8761	(232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-111.1556	-166.8543	-247.0470	-273.4243	-283.2613	-256.0649	-252.7304	-244.8958	-223.5258	-191.6080	-125.5103	-94.5078	-94.5078	(233a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-14.0607	-42.0957	-108.8186	-203.5058	-305.9456	-323.2194	-318.8984	-254.5392	-167.6320	-75.5067	-23.0142	-10.2768	-10.2768	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1														415.7343 (211)
Space heating fuel - main system 2														0.0000 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														283.2473
Water heating fuel used														879.7882 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)														
mechanical ventilation fans (SFP = 0.8680)														231.8063 (230a)
Total electricity for the above, kWh/year														231.8063 (231)
Electricity for lighting (calculated in Appendix L)														187.4834 (232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation														-4318.0985 (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														-2603.2862 (238)

10a. Fuel costs - using Table 12 prices

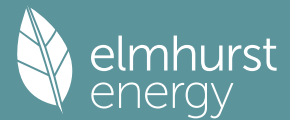
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	415.7343	16.4900	68.5546 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.7882	16.4900	145.0771 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	231.8063	16.4900	38.2249 (249)
Energy for lighting	187.4834	16.4900	30.9160 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2470.5855	16.4900	-407.3995
PV Unit electricity exported	-1847.5130	5.5900	-103.2760
Total			-510.6755 (252)
Total energy cost			-227.9030 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.6189 (257)
SAP value		110.0328
SAP rating (Section 12)		110 (258)
SAP band		A

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	415.7343	0.1565	65.0763 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	879.7882	0.1411	124.1699 (264)
Space and water heating			189.2462 (265)
Pumps, fans and electric keep-hot	231.8063	0.1387	32.1544 (267)
Energy for lighting	187.4834	0.1443	27.0597 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2470.5855	0.1348	-332.9983
PV Unit electricity exported	-1847.5130	0.1204	-222.4461
Total			-555.4444 (269)
Total CO2, kg/year			-306.9841 (272)
CO2 emissions per m2			-3.5100 (273)
EI value			103.1032
EI rating			103 (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	43.7800 (1b)	x 2.4000 (2b)	= 105.0720 (1b) -
First floor	43.7800 (1c)	x 2.6000 (2c)	= 113.8280 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 218.9000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.0000 (17)
Infiltration rate	0.1000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.5000	6.1000	6.0000	5.2000	5.2000	4.7000	4.6000	4.6000	5.0000	5.9000	6.0000	6.4000 (22)
Wind factor	1.6250	1.5250	1.5000	1.3000	1.3000	1.1750	1.1500	1.1500	1.2500	1.4750	1.5000	1.6000 (22a)
Adj infilt rate	0.1625	0.1525	0.1500	0.1300	0.1300	0.1175	0.1150	0.1150	0.1250	0.1475	0.1500	0.1600 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												82.8000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2485	0.2385	0.2360	0.2160	0.2160	0.2035	0.2010	0.2010	0.2110	0.2335	0.2360	0.2460 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.20)			16.3400	1.1450	18.7099		(27)
Half Glazed Door			1.7000	1.2000	2.0400		(26a)

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Ground Floor			43.7800	0.1200	5.2536	110.0000	4815.8000 (28a)
R-Wall	142.0000	18.0400	123.9600	0.1400	17.3544	17.0000	2107.3200 (29a)
Cold roof	43.7800		43.7800	0.0900	3.9402	9.0000	394.0200 (30)
Total net area of external elements Aum(A, m2)			229.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	47.2981			(33)
Internal Wall 1			152.1800			9.0000	1369.6200 (32c)
Internal Floor 1			43.7800			18.0000	788.0400 (32d)
Internal Ceiling 1			43.7800			9.0000	394.0200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9868.8200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.7092 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.1500	0.0140	0.1841
E3 Sill	12.3000	0.0460	0.5658
E4 Jamb	25.0000	0.0050	0.1250
E5 Ground floor (normal)	28.4000	0.0640	1.8176
E6 Intermediate floor within a dwelling	28.4000	0.0490	1.3916
E10 Eaves (insulation at ceiling level)	28.4000	0.0520	1.4768
E16 Corner (normal)	25.0000	0.0420	1.0500
E17 Corner (inverted - internal area greater than external area)	5.0000	0.0790	0.3950

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0059 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 54.3040 (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	17.9509	17.2285	17.0479	15.6032	15.6032	14.7002	14.5196	14.5196	15.2420	16.8673	17.0479	17.7703 (38)
Average = Sum(39)m / 12 =	72.2549	71.5325	71.3520	69.9072	69.9072	69.0043	68.8237	68.8237	69.5460	71.1714	71.3520	72.0743 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8252	0.8170	0.8149	0.7984	0.7984	0.7881	0.7860	0.7860	0.7943	0.8128	0.8149	0.8231 (40)
HLP (average)												0.8049
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5908 (42)

Hot water usage for mixer showers 67.6594 66.6426 65.1610 62.3261 60.2340 57.9009 56.5748 58.0453 59.6571 62.1621 65.0579 67.4002 (42a)

Hot water usage for baths 29.2190 28.7850 28.1740 27.0472 26.2036 25.2680 24.7627 25.3695 26.0302 27.0313 28.1812 29.1202 (42b)

Hot water usage for other uses 41.1627 39.6658 38.1690 36.6722 35.1754 33.6785 33.6785 35.1754 36.6722 38.1690 39.6658 41.1627 (42c)

Average daily hot water use (litres/day) 126.8909 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	138.0411	135.0935	131.5039	126.0455	121.6129	116.8475	115.0161	118.5902	122.3596	127.3624	132.9050	137.6830 (44)
Energy content (annual)	218.6233	192.3713	202.1166	172.5500	163.7144	143.6776	139.1020	146.8394	150.8816	172.8296	189.3475	215.5784 (45)
Distribution loss (46)m = 0.15 x (45)m	32.7935	28.8557	30.3175	25.8825	24.5572	21.5516	20.8653	22.0259	22.6322	25.9244	28.4021	32.3368 (46)

Water storage loss:
 Store volume 170.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.9500 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 1.0530 (55)

Total storage loss	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (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	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214 (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	72.6922	63.9635	67.2038	57.3729	54.4350	47.7728	46.2514	48.8241	50.1681	57.4658	62.9580	71.6798 (65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497	155.4497 (66)
	26.5402	23.5728	19.1707	14.5134	10.8490	9.1592	9.8968	12.8642	17.2663	21.9236	25.5880	27.2779 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.0246	353.6567	344.5038	325.0183	300.4214	277.3037	261.8597	258.2275	267.3805	286.8660	311.4629	334.5806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	53.1358	(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)	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	-103.6331	(71)
Water heating gains (Table 5)	97.7046	95.1837	90.3277	79.6845	73.1654	66.3511	62.1659	65.6238	69.6780	77.2390	87.4417	96.3438	(72)
Total internal gains	579.2218	577.3656	558.9545	524.1686	489.3880	457.7664	438.8747	441.6679	459.2771	490.9809	529.4450	563.1546	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	5.7900	13.8487	0.6300	0.6300	0.7000	0.7700	24.5053	(74)
East	1.8900	25.8938	0.6300	0.6300	0.7000	0.7700	14.9565	(76)
South	8.6600	58.0763	0.6300	0.6300	0.7000	0.7700	153.7053	(78)

Solar gains	193.1671	279.7868	384.4244	490.0876	541.2838	566.4794	497.6440	480.9044	426.2955	314.4329	223.6451	164.0225	(83)
Total gains	772.3889	857.1524	943.3789	1014.2562	1030.6718	1024.2457	936.5187	922.5723	885.5726	805.4138	753.0901	727.1771	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	37.9398	38.3230	38.4200	39.2140	39.2140	39.7271	39.8313	39.8313	39.4176	38.5174	38.4200	38.0349	
tau	3.5293	3.5549	3.5613	3.6143	3.6143	3.6485	3.6554	3.6554	3.6278	3.5678	3.5613	3.5357	
util living area	0.8875	0.8525	0.7916	0.7037	0.5856	0.4492	0.3750	0.3666	0.4941	0.6990	0.8279	0.8971	(86)
Living	20.2040	20.3302	20.5069	20.6857	20.8168	20.8861	20.9035	20.9048	20.8758	20.7336	20.4902	20.1876	
Non living	19.3137	19.4719	19.6847	19.9056	20.0517	20.1311	20.1489	20.1500	20.1175	19.9549	19.6719	19.2964	
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	20.5928	20.3302	20.5069	20.6857	20.8168	20.8861	20.9035	20.9048	20.8758	20.7336	20.4902	20.3012	(87)
Th 2	20.2315	20.2387	20.2404	20.2547	20.2547	20.2637	20.2655	20.2655	20.2583	20.2422	20.2404	20.2333	(88)
util rest of house	0.8733	0.8353	0.7692	0.6751	0.5484	0.4053	0.3244	0.3149	0.4448	0.6610	0.8047	0.8835	(89)
MIT 2	19.8656	19.4719	19.6847	19.9056	20.0517	20.1311	20.1489	20.1500	20.1175	19.9549	19.6719	19.4652	(90)
Living area fraction									fLA = Living area / (4) =			0.3835	(91)
MIT	20.1445	19.8011	20.0000	20.2048	20.3451	20.4206	20.4383	20.4395	20.4083	20.2536	19.9857	19.7859	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1445	19.8011	20.0000	20.2048	20.3451	20.4206	20.4383	20.4395	20.4083	20.2536	19.9857	19.7859	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8715	0.8245	0.7616	0.6731	0.5530	0.4148	0.3364	0.3273	0.4550	0.6616	0.7961	0.8746	(94)	
Useful gains	673.1548	706.6949	718.4756	682.6471	569.9718	424.8215	315.0807	301.9229	402.9249	532.8927	599.5500	635.9718	(95)	
Ext temp.	6.1000	6.3000	7.4000	9.0000	11.6000	14.1000	15.8000	16.0000	14.4000	11.7000	9.0000	6.4000	(96)	
Heat loss rate W	1014.7830	965.7660	899.0366	783.2940	611.3487	436.1516	319.2241	305.5418	417.8538	608.7685	783.8506	964.7768	(97)	
Space heating kWh	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309	(98a)	
Space heating requirement - total per year (kWh/year)													1099.6337	
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	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													1099.6337	
Space heating per m2										(98c) / (4) =			12.5586	(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 %)													332.1673	(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	254.1714	174.0958	134.3374	72.4658	30.7844	0.0000	0.0000	0.0000	0.0000	56.4516	132.6964	244.6309	(98)	

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Space heating efficiency (main heating system 1)	332.1673	332.1673	332.1673	332.1673	332.1673	0.0000	0.0000	0.0000	0.0000	0.0000	332.1673	332.1673	332.1673	(210)
Space heating fuel (main heating system)	76.5191	52.4121	40.4427	21.8160	9.2678	0.0000	0.0000	0.0000	0.0000	0.0000	16.9949	39.9487	73.6469	(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	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	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	0.0000	(215)
Water heating requirement	251.2663	221.8553	234.7596	204.1400	196.3574	175.2676	171.7450	179.4824	182.4716	205.4726	220.9375	248.2214	283.2214	(64)
Efficiency of water heater (217)m	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	283.3264	(216)
Fuel for water heating, kWh/month	88.6844	78.3038	82.8584	72.0512	69.3043	61.8607	60.6174	63.3483	64.4033	72.5215	77.9799	87.6097	87.6097	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	19.6877	17.7824	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	19.0526	19.6877	(231)
Lighting	23.2305	18.6364	16.7800	12.2937	9.4960	7.7583	8.6626	11.2600	14.6256	19.1896	21.6746	23.8761	23.8761	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-138.1617	-179.3012	-262.6167	-287.8165	-290.5135	-262.1412	-254.9987	-252.9325	-236.1321	-206.2706	-149.7231	-116.9687	-116.9687	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-23.6398	-51.7040	-132.5888	-249.8405	-352.5998	-398.0385	-341.1183	-305.2652	-207.0904	-94.4539	-36.1891	-17.0578	-17.0578	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1														331.0481 (211)
Space heating fuel - main system 2														0.0000 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														283.3264
Water heating fuel used														879.5428 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)														
mechanical ventilation fans (SFP = 0.8680)														231.8063 (230a)
Total electricity for the above, kWh/year														231.8063 (231)
Electricity for lighting (calculated in Appendix L)														187.4834 (232)
Energy saving/generation technologies (Appendices M,N and Q)														
PV generation														-4847.1626 (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														-3217.2819 (238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	331.0481	21.5100	71.2085 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.5428	21.5100	189.1897 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	231.8063	21.5100	49.8615 (249)
Energy for lighting	187.4834	21.5100	40.3277 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	21.5100	-567.3427
PV Unit electricity exported	-2209.5860	5.5900	-123.5159
Total			-690.8586 (252)
Total energy cost			-340.2712 (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	331.0481	0.1563	51.7373 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	879.5428	0.1411	124.1353 (264)
Space and water heating			175.8726 (265)

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Pumps, fans and electric keep-hot	231.8063	0.1387	32.1544 (267)
Energy for lighting	187.4834	0.1443	27.0597 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	0.1355	-357.5197
PV Unit electricity exported	-2209.5860	0.1216	-268.6267
Total			-626.1464 (269)
Total CO2, kg/year			-391.0598 (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	331.0481	1.5786	522.5799 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	879.5428	1.5219	1338.5603 (278)
Space and water heating			1861.1402 (279)
Pumps, fans and electric keep-hot	231.8063	1.5128	350.6766 (281)
Energy for lighting	187.4834	1.5338	287.5684 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2637.5766	1.5010	-3959.0579
PV Unit electricity exported	-2209.5860	0.4461	-985.7570
Total			-4944.8149 (283)
Total Primary energy kWh/year			-2445.4297 (286)