

Full SAP Calculation Printout



Property Reference	NGF-7115-23		Issued on Date	21/11/2023	
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	Prop Type Ref	DS		
Property	Proposed dwelling, Wynroe, Hornick Hill, St Austell, Cornwall, PL26 7RT				
SAP Rating	97 A	DER	-0.27	TER	8.35
Environmental	100 A	% DER < TER			103.23
CO ₂ Emissions (t/year)	-0.15	DFEE	36.06	TFEE	40.46
Compliance Check	See BREEL	% DFEE < TFEE			10.87
% DPER < TPER	82.92	DPER	7.50	TPER	43.91
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
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	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	431.3118 (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												3.0000 (17)
Infiltration rate												0.1500 (18)
Number of sides sheltered												2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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) =												81.0000 (23c)
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (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
Window (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Door			4.1000	1.0000	4.1000		(26a)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632	110.0000	5130.4000 (28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1200	4.0140	110.0000	3679.5000 (28a)
Floor 3 over garage			15.1200	0.1700	2.5704	20.0000	302.4000 (28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1700	18.4144	9.0000	974.8800 (29a)
External Wall 4 retaining	2.4800		2.4800	0.1700	0.4216	9.0000	22.3200 (29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1700	12.0071	9.0000	635.6700 (29a)
External Wall 3 Garage	12.6800		12.6800	0.1700	2.1556	18.0000	228.2400 (29a)
External Roof 1 Horz	95.2200		95.2200	0.0900	8.5698	9.0000	856.9800 (30)
Total net area of external elements Aum(A, m ²)	426.4600						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	101.6214		
Internal Wall 1 GF					77.9800	9.0000	701.8200 (32c)
Internal Wall 2 TF					178.5600	9.0000	1607.0400 (32c)

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Internal Floor 1	80.0900	18.0000	1441.6200 (32d)
Internal Ceiling 1	80.0900	9.0000	720.8100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16301.6800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.9771 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.1200	0.0300	0.7236
E5 Ground floor (normal)	42.7800	0.0210	0.8984
E6 Intermediate floor within a dwelling	37.9400	0.0800	3.0352
E10 Eaves (insulation at ceiling level)	49.0300	0.0440	2.1573
E17 Corner (inverted - internal area greater than external area)	4.6600	-0.0150	-0.0699
E2 Other lintels (including other steel lintels)	26.7800	0.0840	2.2495
E3 Sill	24.8300	0.0430	1.0677
E4 Jamb	64.0800	0.0340	2.1787
E20 Exposed floor (normal)	11.0900	0.3200	3.5488
E21 Exposed floor (inverted)	4.8400	0.3200	1.5488
E22 Basement floor	4.9600	0.0210	0.1042
E6 Intermediate floor within a dwelling	4.9600	0.0800	0.3968

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8391 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 119.4605 (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	36.6596	36.2059	35.7522	33.4838	33.0301	30.7617	30.7617	30.3080	31.6691	33.0301	33.9375	34.8449 (38)
Heat transfer coeff	156.1201	155.6665	155.2128	152.9443	152.4907	150.2222	150.2222	149.7685	151.1296	152.4907	153.3980	154.3054 (39)
Average = Sum(39)m / 12 =												152.8309

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8904	0.8878	0.8853	0.8723	0.8697	0.8568	0.8568	0.8542	0.8620	0.8697	0.8749	0.8801 (40)
HLP (average)												0.8717
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9697 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 85.3806 84.1126 82.3270 79.0346 76.5692 73.8356 72.3590 74.1322 76.0628 78.9879 82.3481 85.0920 (42b)

Hot water usage for other uses 45.0423 43.4044 41.7665 40.1286 38.4907 36.8528 36.8528 38.4907 40.1286 41.7665 43.4044 45.0423 (42c)

Average daily hot water use (litres/day) 120.1088 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343 (44)
Energy conte	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588 (45)
Energy content (annual)												Total = Sum(45)m = 1994.5806
Distribution loss (46)m = 0.15 x (45)m	30.9837	27.2374	28.6091	24.4693	23.2339	20.4156	19.8123	20.9176	21.4913	24.5794	26.8736	30.5638 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9720 (55)
Enter (49) or (54) in (55)												
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532 (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	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532 (64)
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2623.2566 (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	111.3961	98.9579	106.1323	95.5778	94.2174	86.5923	86.6329	89.0829	88.9767	97.1998	100.9075	110.4653 (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	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.1946	193.9655	175.1946	181.0345	175.1946	181.0345	175.1946	175.1946	181.0345	175.1946	181.0345	175.1946 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.9472	350.5474	341.4749	322.1608	297.7801	274.8657	259.5575	255.9572	265.0297	284.3439	308.7245	331.6389 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483 (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)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865 (71)
Water heating gains (Table 5)	149.7259	147.2588	142.6509	132.7469	126.6363	120.2671	116.4420	119.7350	123.5788	130.6449	140.1493	148.4749 (72)
Total internal gains	739.4126	759.3167	726.8654	703.4871	667.1559	643.7121	618.7390	618.4318	637.1879	657.7284	697.4532	722.8534 (73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East		10.5600	19.6403	0.7600	0.7000	0.7700	76.4638 (76)
South		18.8200	46.7521	0.7600	0.7000	0.7700	324.3884 (78)
West		8.4400	19.6403	0.7600	0.7000	0.7700	61.1131 (80)

Solar gains	461.9654	800.3943	1119.9552	1411.2671	1589.2277	1577.9882	1521.5004	1390.9984	1222.4128	892.3638	556.0532	393.4380 (83)
Total gains	1201.3780	1559.7110	1846.8206	2114.7542	2256.3836	2221.7003	2140.2394	2009.4302	1859.6007	1550.0922	1253.5064	1116.2914 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.0049	29.0894	29.1744	29.6071	29.6952	30.1436	30.1436	30.2350	29.9627	29.6952	29.5196	29.3460
alpha	2.9337	2.9393	2.9450	2.9738	2.9797	3.0096	3.0096	3.0157	2.9975	2.9797	2.9680	2.9564
util living area	0.9417	0.8892	0.8150	0.6965	0.5591	0.4123	0.3026	0.3338	0.5125	0.7572	0.9031	0.9511 (86)
Living	19.4119	19.7693	20.1449	20.5143	20.7381	20.8517	20.8843	20.8796	20.8063	20.4792	19.8849	19.3512
Non living	18.2928	18.7394	19.2020	19.6513	19.9069	20.0358	20.0650	20.0639	19.9897	19.6234	18.8986	18.2231
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	20.1876	19.7693	20.1449	20.5143	20.7381	20.8517	20.8843	20.8796	20.8063	20.4792	19.8849	19.5819 (87)
Th 2	20.1756	20.1778	20.1800	20.1911	20.1933	20.2044	20.2044	20.2066	20.1999	20.1933	20.1889	20.1845 (88)
util rest of house	0.9346	0.8771	0.7960	0.6683	0.5215	0.3660	0.2500	0.2791	0.4633	0.7267	0.8903	0.9451 (89)
MIT 2	19.4250	18.7394	19.2020	19.6513	19.9069	20.0358	20.0650	20.0639	19.9897	19.6234	18.8986	18.5765 (90)
Living area fraction										FLA = Living area / (4) =		0.0907 (91)
MIT	19.4942	18.8328	19.2875	19.7295	19.9823	20.1098	20.1393	20.1379	20.0638	19.7010	18.9881	18.6677 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4942	18.8328	19.2875	19.7295	19.9823	20.1098	20.1393	20.1379	20.0638	19.7010	18.9881	18.6677 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9280	0.8534	0.7727	0.6511	0.5112	0.3603	0.2456	0.2743	0.4545	0.7059	0.8672	0.9311 (94)
Useful gains	1114.8402	1331.1276	1427.1162	1376.8657	1153.4248	800.5775	525.6083	551.2030	845.2243	1094.2873	1087.0990	1039.4207 (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	2372.1188	2168.8730	1984.7833	1656.3133	1262.9726	827.6961	531.6759	559.8132	901.3010	1387.8231	1823.6085	2232.4438 (97)
Space heating kWh	935.4152	562.9649	414.9043	201.2023	81.5036	0.0000	0.0000	0.0000	0.0000	218.3906	530.2868	887.6092 (98a)
Space heating requirement - total per year (kWh/year)												3832.2770
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	935.4152	562.9649	414.9043	201.2023	81.5036	0.0000	0.0000	0.0000	0.0000	218.3906	530.2868	887.6092 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3832.2770
Space heating per m2										(98c) / (4) =		21.8575 (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 %)												391.9862 (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	935.4152	562.9649	414.9043	201.2023	81.5036	0.0000	0.0000	0.0000	0.0000	218.3906	530.2868	887.6092 (98)
Space heating efficiency (main heating system 1)	391.9862	391.9862	391.9862	391.9862	391.9862	0.0000	0.0000	0.0000	0.0000	391.9862	391.9862	391.9862 (210)
Space heating fuel (main heating system)	238.6347	143.6185	105.8467	51.3289	20.7925	0.0000	0.0000	0.0000	0.0000	55.7139	135.2820	226.4389 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532 (64)
Efficiency of water heater (217)m	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922 (216)
Fuel for water heating, kWh/month	130.6345	115.4868	122.6789	107.9441	104.6710	94.3636	93.2080	96.9108	97.9675	109.1786	115.9993	129.2278 (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	37.3617	33.7460	37.3617	36.1565	37.3617	36.1565	37.3617	37.3617	36.1565	37.3617	36.1565	37.3617 (231)
Lighting	42.3846	34.0025	30.6155	22.4302	17.3257	14.1553	15.8051	20.5441	26.6848	35.0118	39.5458	43.5626 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.2789	-96.7431	-153.2527	-181.3330	-197.8774	-182.5668	-179.7522	-167.1076	-142.2534	-113.0226	-70.1912	-52.1029 (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	-23.2388	-59.4175	-145.4838	-261.7146	-382.9515	-401.3265	-391.0607	-309.9621	-200.9360	-95.8036	-33.9706	-17.5826 (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)												

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(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												977.6561	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												198.9922	
Water heating fuel used												1318.2709	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360) mechanical ventilation fans (SFP = 0.8360)												439.9035	(230a)
Total electricity for the above, kWh/year												439.9035	(231)
Electricity for lighting (calculated in Appendix L)												342.0680	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3921.9303	(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												-844.0318	(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	977.6561	0.1566	153.0698	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1318.2709	0.1409	185.6978	(264)
Space and water heating			338.7676	(265)
Pumps, fans and electric keep-hot	439.9035	0.1387	61.0200	(267)
Energy for lighting	342.0680	0.1443	49.3710	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1598.4820	0.1336	-213.5227	
PV Unit electricity exported	-2323.4483	0.1216	-282.6202	
Total			-496.1429	(269)
Total CO2, kg/year			-46.9842	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.2700	(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	977.6561	1.5796	1544.2674	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1318.2709	1.5209	2004.9117	(278)
Space and water heating			3549.1790	(279)
Pumps, fans and electric keep-hot	439.9035	1.5128	665.4861	(281)
Energy for lighting	342.0680	1.5338	524.6754	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1598.4820	1.4936	-2387.5608	
PV Unit electricity exported	-2323.4483	0.4463	-1036.9374	
Total			-3424.4982	(283)
Total Primary energy kWh/year			1314.8423	(286)
Dwelling Primary energy Rate (DPER)			7.5000	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b)	- (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.3118	(5)

2. Ventilation rate

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

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0927 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3427 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2913 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.3714	0.3642	0.3569	0.3205	0.3132	0.2768	0.2768	0.2695	0.2913	0.3132	0.3277	0.3423 (22b)
Effective ac	0.5690	0.5663	0.5637	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5537	0.5586 (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			4.1000	1.0000	4.1000		(26a)
TER Opening Type (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632		(28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1300	4.3485		(28a)
Floor 3 over garage			15.1200	0.1300	1.9656		(28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1800	19.4976		(29a)
External Wall 4 retaining	2.4800		2.4800	0.1800	0.4464		(29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1800	12.7134		(29a)
External Wall 3 Garage	12.6800		12.6800	0.1800	2.2824		(29a)
External Roof 1 Horz	95.2200		95.2200	0.1100	10.4742		(30)
Total net area of external elements Aum(A, m2)			426.4600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.1966	(33)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.1200	0.0900	2.1708
E5 Ground floor (normal)	42.7800	0.1600	6.8448
E6 Intermediate floor within a dwelling	37.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	49.0300	0.0600	2.9418
E17 Corner (inverted - internal area greater than external area)	4.6600	-0.0900	-0.4194
E2 Other lintels (including other steel lintels)	26.7800	0.0500	1.3390
E3 Sill	24.8300	0.0500	1.2415
E4 Jamb	64.0800	0.0500	3.2040
E20 Exposed floor (normal)	11.0900	0.3200	3.5488
E21 Exposed floor (inverted)	4.8400	0.3200	1.5488
E22 Basement floor	4.9600	0.0700	0.3472
E6 Intermediate floor within a dwelling	4.9600	0.0000	0.0000

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

Point Thermal bridges

Total fabric heat loss

(39)m	80.9854	80.6041	80.2304	78.4750	78.1465	76.6176	76.6176	76.3345	77.2065	78.1465	78.8109	79.5055 (38)	
Heat transfer coeff	208.9493	208.5680	208.1943	206.4389	206.1105	204.5816	204.5816	204.2984	205.1705	206.1105	206.7749	207.4695 (39)	
Average = Sum(39)m / 12 =												206.4373	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1917	1.1896	1.1874	1.1774	1.1756	1.1668	1.1668	1.1652	1.1702	1.1756	1.1793	1.1833 (40)
HLP (average)												1.1774
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9697 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	85.3806	84.1126	82.3270	79.0346	76.5692	73.8356	72.3590	74.1322	76.0628	78.9879	82.3481	85.0920 (42b)	
Hot water usage for other uses	45.0423	43.4044	41.7665	40.1286	38.4907	36.8528	36.8528	38.4907	40.1286	41.7665	43.4044	45.0423 (42c)	
Average daily hot water use (litres/day)													120.1088 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343 (44)	
Energy conte	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588 (45)	
Energy content (annual)													Total = Sum(45)m = 1994.5806
Distribution loss (46)m = 0.15 x (45)m	30.9837	27.2374	28.6091	24.4693	23.2339	20.4156	19.8123	20.9176	21.4913	24.5794	26.8736	30.5638 (46)	
Water storage loss:													250.0000 (47)
Store volume													1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.0208 (55)
Enter (49) or (54) in (55)													
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)	
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (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 (61)	
Total heat required for water heating calculated for each month	261.4648	231.1757	245.6338	216.2640	209.7996	189.2399	186.9890	194.3574	196.4112	218.7694	232.2931	258.6656 (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	261.4648	231.1757	245.6338	216.2640	209.7996	189.2399	186.9890	194.3574	196.4112	218.7694	232.2931	258.6656 (64)	
Total per year (kWh/year) = Sum(64)m =													2641.0637 (64)

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12Total per year (kWh/year)												2641 (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	112.6060	100.0508	107.3422	96.7487	95.4273	87.7632	87.8428	90.2928	90.1476	98.4097	102.0784	111.6752 (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	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.1946	193.9655	175.1946	181.0345	175.1946	181.0345	175.1946	175.1946	181.0345	175.1946	181.0345	175.1946 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.9472	350.5474	341.4749	322.1608	297.7801	274.8657	259.5575	255.9572	265.0297	284.3439	308.7245	331.6389 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865 (71)
Water heating gains (Table 5)	151.3521	148.8851	144.2771	134.3732	128.2625	121.8933	118.0682	121.3613	125.2050	132.2712	141.7755	150.1011 (72)
Total internal gains	744.0389	763.9429	731.4916	708.1133	671.7821	645.3383	620.3653	620.0580	638.8141	662.3546	702.0794	727.4796 (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						
East	10.5600	19.6403	0.6300	0.7000	0.7700	63.3845 (76)						
South	18.8200	46.7521	0.6300	0.7000	0.7700	268.9009 (78)						
West	8.4400	19.6403	0.6300	0.7000	0.7700	50.6596 (80)						
Solar gains	382.9450	663.4848	928.3839	1169.8662	1317.3861	1308.0692	1261.2437	1153.0644	1013.3159	739.7226	460.9388	326.1394 (83)
Total gains	1126.9838	1427.4277	1659.8755	1877.9795	1989.1683	1953.4075	1881.6090	1773.1225	1652.1300	1402.0772	1163.0182	1053.6191 (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)	21.6715	21.7111	21.7501	21.9350	21.9700	22.1342	22.1342	22.1649	22.0706	21.9700	21.8994	21.8261
tau	2.4448	2.4474	2.4500	2.4623	2.4647	2.4756	2.4756	2.4777	2.4714	2.4647	2.4600	2.4551
util living area	0.9564	0.9252	0.8809	0.8041	0.6981	0.5610	0.4348	0.4720	0.6551	0.8423	0.9328	0.9624 (86)
MIT	18.1150	18.5609	19.1349	19.8122	20.3644	20.7423	20.9010	20.8757	20.5982	19.8417	18.8499	18.0344 (87)
Th 2	19.9266	19.9283	19.9301	19.9381	19.9396	19.9466	19.9466	19.9479	19.9439	19.9396	19.9366	19.9334 (88)
util rest of house	0.9501	0.9149	0.8643	0.7762	0.6533	0.4923	0.3443	0.3812	0.5915	0.8134	0.9217	0.9570 (89)
MIT 2	16.5580	17.1193	17.8369	18.6714	19.3238	19.7419	19.8897	19.8722	19.6008	18.7283	17.4968	16.4599 (90)
Living area fraction	16.6992	17.2501	17.9546	18.7748	19.4182	19.8327	19.9814	19.9632	19.6913	18.8293	17.6195	16.6027 (92)
MIT	16.6992	17.2501	17.9546	18.7748	19.4182	19.8327	19.9814	19.9632	19.6913	18.8293	17.6195	16.6027 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6992	17.2501	17.9546	18.7748	19.4182	19.8327	19.9814	19.9632	19.6913	18.8293	17.6195	16.6027 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9217	0.8791	0.8247	0.7397	0.6284	0.4843	0.3475	0.3826	0.5744	0.7755	0.8873	0.9309 (94)
Useful gains	1038.7650	1254.7931	1368.8557	1389.1959	1250.0351	945.9432	653.8681	678.4386	948.9474	1087.2875	1032.0015	980.8049 (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	2590.8048	2575.8263	2384.7884	2038.5519	1590.8043	1070.5053	691.7762	727.9489	1147.1607	1696.1350	2175.1616	2573.1770 (97)
Space heating kWh	1154.7176	887.7344	755.8540	467.5364	253.5323	0.0000	0.0000	0.0000	0.0000	452.9826	823.0753	1184.7249 (98a)
Space heating requirement - total per year (kWh/year)												5980.1573
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	1154.7176	887.7344	755.8540	467.5364	253.5323	0.0000	0.0000	0.0000	0.0000	452.9826	823.0753	1184.7249 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5980.1573
Space heating per m2												(98c) / (4) = 34.1080 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	1154.7176	887.7344	755.8540	467.5364	253.5323	0.0000	0.0000	0.0000	0.0000	452.9826	823.0753	1184.7249 (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)	1251.0483	961.7924	818.9100	506.5400	274.6829	0.0000	0.0000	0.0000	0.0000	490.7720	891.7392	1283.5589 (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	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	261.4648	231.1757	245.6338	216.2640	209.7996	189.2399	186.9890	194.3574	196.4112	218.7694	232.2931	258.6656	(64)
Efficiency of water heater (217)m	86.9887	86.7779	86.4097	85.7417	84.4855	79.8000	79.8000	79.8000	79.8000	85.6540	86.6490	87.0408	(216)
Fuel for water heating, kWh/month	300.5734	266.3992	284.2663	252.2275	248.3263	237.1427	234.3221	243.5557	246.1294	255.4107	268.0851	297.1775	(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	36.4020	29.2030	26.2941	19.2642	14.8802	12.1573	13.5742	17.6443	22.9182	30.0699	33.9639	37.4137	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-79.1663	-106.9129	-147.2332	-158.2851	-164.6658	-151.4055	-149.2930	-143.6524	-133.1454	-118.4526	-85.2397	-68.9866	(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	-60.2399	-124.5469	-243.7362	-360.8027	-472.2267	-472.9181	-467.5619	-398.2621	-294.9744	-176.5723	-79.8883	-47.8247	(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												6479.0436	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	(216)
Water heating fuel used												3133.6159	(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)												293.7849	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4705.9928	(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												5286.4516	(238)

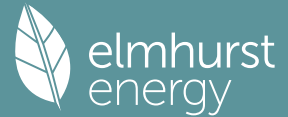
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6479.0436	0.2100	1360.5992 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3133.6159	0.2100	658.0593 (264)
Space and water heating			2018.6585 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	293.7849	0.1443	42.4022 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1506.4386	0.1356	-204.2061
PV Unit electricity exported	-3199.5542	0.1263	-404.1650
Total			-608.3710 (269)
Total CO2, kg/year			1464.6190 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3500 (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	6479.0436	1.1300	7321.3193 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3133.6159	1.1300	3540.9860 (278)
Space and water heating			10862.3053 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	293.7849	1.5338	450.6170 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1506.4386	1.5010	-2261.2304
PV Unit electricity exported	-3199.5542	0.4637	-1483.6214
Total			-3744.8518 (283)
Total Primary energy kWh/year			7698.1713 (286)
Target Primary Energy Rate (TPER)			43.9100 (287)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	431.3118 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0927 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2427 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2063 (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	0.2631	0.2579	0.2528	0.2270	0.2218	0.1960	0.1960	0.1909	0.2063	0.2218	0.2321	0.2424 (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	0.5346	0.5333	0.5319	0.5258	0.5246	0.5192	0.5192	0.5182	0.5213	0.5246	0.5269	0.5294 (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
Window (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Door			4.1000	1.0000	4.1000		(26a)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632	110.0000	5130.4000 (28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1200	4.0140	110.0000	3679.5000 (28a)
Floor 3 over garage			15.1200	0.1700	2.5704	20.0000	302.4000 (28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1700	18.4144	9.0000	974.8800 (29a)
External Wall 4 retaining	2.4800		2.4800	0.1700	0.4216	9.0000	22.3200 (29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1700	12.0071	9.0000	635.6700 (29a)
External Wall 3 Garage	12.6800		12.6800	0.1700	2.1556	18.0000	228.2400 (29a)
External Roof 1 Horz	95.2200		95.2200	0.0900	8.5698	9.0000	856.9800 (30)
Total net area of external elements Aum(A, m ²)			426.4600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	101.6214	(33)
Internal Wall 1 GF			77.9800			9.0000	701.8200 (32c)
Internal Wall 2 TF			178.5600			9.0000	1607.0400 (32c)
Internal Floor 1			80.0900			18.0000	1441.6200 (32d)
Internal Ceiling 1			80.0900			9.0000	720.8100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16301.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.9771 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	24.1200	0.0300	0.7236
E16 Corner (normal)	42.7800	0.0210	0.8984
E5 Ground floor (normal)	37.9400	0.0800	3.0352
E6 Intermediate floor within a dwelling	49.0300	0.0440	2.1573
E10 Eaves (insulation at ceiling level)	4.6600	-0.0150	-0.0699
E17 Corner (inverted - internal area greater than external area)	26.7800	0.0840	2.2495
E2 Other lintels (including other steel lintels)	24.8300	0.0430	1.0677
E3 Sill	64.0800	0.0340	2.1787
E4 Jamb	11.0900	0.3200	3.5488
E20 Exposed floor (normal)	4.8400	0.3200	1.5488
E21 Exposed floor (inverted)	4.9600	0.0210	0.1042
E22 Basement floor	4.9600	0.0800	0.3968
E6 Intermediate floor within a dwelling			17.8391 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			(36a) = 0.0000
Point Thermal bridges			(33) + (36) + (36a) = 119.4605 (37)
Total fabric heat loss			

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	76.0916	75.9003	75.7129	74.8324	74.6676	73.9007	73.9007	73.7587	74.1961	74.6676	75.0009	75.3493 (38)
Heat transfer coeff	195.5521	195.3609	195.1734	194.2929	194.1282	193.3613	193.3613	193.2193	193.6567	194.1282	194.4614	194.8098 (39)
Average = Sum(39)m / 12 =												194.2921
HLP	1.1153	1.1142	1.1132	1.1082	1.1072	1.1028	1.1028	1.1020	1.1045	1.1072	1.1091	1.1111 (40)
HLP (average)												1.1082
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9697 (42)
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Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.9505	31.4760	30.8078	29.5757	28.6532	27.6302	27.0777	27.7412	28.4637	29.5583	30.8157	31.8425	(42b)
Hot water usage for other uses	45.0423	43.4044	41.7665	40.1286	38.4907	36.8528	36.8528	38.4907	40.1286	41.7665	43.4044	45.0423	(42c)
Average daily hot water use (litres/day)													70.5707 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	76.9928	74.8804	72.5743	69.7043	67.1439	64.4830	63.9305	66.2319	68.5923	71.3248	74.2201	76.8848	(44)
Distribution loss (46)m = 0.15 x (45)m	121.9378	106.6287	111.5440	95.4217	90.3886	79.2894	77.3183	82.0089	84.5811	96.7870	105.7401	120.3830	(45)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	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	0.0000 (61)
WWHRS	103.6471	90.6344	94.8124	81.1085	76.8303	67.3960	65.7206	69.7076	71.8940	82.2690	89.8791	102.3256	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	103.6471	90.6344	94.8124	81.1085	76.8303	67.3960	65.7206	69.7076	71.8940	82.2690	89.8791	102.3256	(64)
Total per year (kWh/year)													996.2244 (64)
Electric shower(s)	59.2707	52.8107	57.6673	55.0312	56.0638	53.4794	55.2621	56.0638	55.0312	57.6673	56.5829	59.2707	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													674.2011 (64a)
Heat gains from water heating, kWh/month	40.7295	35.8613	38.1199	34.0349	33.2235	30.2189	30.2457	31.4428	31.7313	34.9841	36.6155	40.3991	(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	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.1946	193.9655	175.1946	181.0345	175.1946	181.0345	175.1946	175.1946	181.0345	175.1946	181.0345	175.1946	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.9472	350.5474	341.4749	322.1608	297.7801	274.8657	259.5575	255.9572	265.0297	284.3439	308.7245	331.6389	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	(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)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	(71)
Water heating gains (Table 5)	54.7439	53.3650	51.2364	47.2707	44.6553	41.9706	40.6528	42.2619	44.0712	47.0216	50.8549	54.2998	(72)
Total internal gains	644.4306	665.4228	635.4509	618.0109	585.1749	565.4157	542.9498	540.9587	557.6803	574.1050	608.1588	628.6783	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	10.5600	19.6403	0.7600	0.7000	0.7700	76.4638	(76)						
South	18.8200	46.7521	0.7600	0.7000	0.7700	324.3884	(78)						
West	8.4400	19.6403	0.7600	0.7000	0.7700	61.1131	(80)						
Solar gains	461.9654	800.3943	1119.9552	1411.2671	1589.2277	1577.9882	1521.5004	1390.9984	1222.4128	892.3638	556.0532	393.4380	(83)
Total gains	1106.3960	1465.8171	1755.4062	2029.2780	2174.4026	2143.4039	2064.4501	1931.9570	1780.0931	1466.4688	1164.2120	1022.1164	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.1562	23.1789	23.2011	23.3063	23.3261	23.4186	23.4186	23.4358	23.3828	23.3261	23.2861	23.2444	
alpha	2.5437	2.5453	2.5467	2.5538	2.5551	2.5612	2.5612	2.5624	2.5589	2.5551	2.5524	2.5496	
util living area	0.9569	0.9180	0.8621	0.7692	0.6492	0.5078	0.3860	0.4238	0.6102	0.8220	0.9302	0.9640	(86)
MIT	18.2859	18.7859	19.3795	20.0259	20.5143	20.8157	20.9334	20.9134	20.6913	19.9965	19.0031	18.1825	(87)
Th 2	19.9883	19.9892	19.9901	19.9942	19.9949	19.9985	19.9985	19.9992	19.9971	19.9949	19.9934	19.9918	(88)
util rest of house	0.9509	0.9073	0.8443	0.7399	0.6046	0.4441	0.3065	0.3427	0.5485	0.7919	0.9191	0.9590	(89)
MIT 2	17.5093	17.9987	18.5738	19.1878	19.6304	19.8850	19.9685	19.9580	19.7927	19.1778	18.2218	17.4098	(90)
Living area fraction	17.5797	18.0701	18.6469	19.2638	19.7106	19.9694	20.0560	20.0446	19.8742	19.2521	18.2927	17.4799	(91)
Temperature adjustment	17.5797	18.0701	18.6469	19.2638	19.7106	19.9694	20.0560	20.0446	19.8742	19.2521	18.2927	17.4799	(92)
adjusted MIT	17.5797	18.0701	18.6469	19.2638	19.7106	19.9694	20.0560	20.0446	19.8742	19.2521	18.2927	17.4799	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1030.2104	1291.4626	1432.0861	1452.5921	1284.9683	947.7633	642.6525	669.5510	961.7796	1122.7028	1041.2428	961.9581	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W													(96)

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Space heating kWh	2596.8797	2572.9186	2370.7433	2013.6125	1555.0761	1038.2290	668.2577	704.2106	1118.2075	1679.6071	2176.5459	2587.0551 (97)
Space heating requirement - total per year (kWh/year)	1165.6019	861.1384	698.3609	403.9347	200.9602	0.0000	0.0000	0.0000	0.0000	414.3368	817.4182	1209.0721 (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)	1165.6019	861.1384	698.3609	403.9347	200.9602	0.0000	0.0000	0.0000	0.0000	414.3368	817.4182	1209.0721 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5770.8233
Space heating per m2												(98c) / (4) = 32.9141 (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	1817.5959	1430.8734	1468.4663	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8138	0.8665	0.8438	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1479.1090	1239.7867	1239.0762	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2427.1294	2338.1732	2186.8404	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	682.5747	817.1996	705.1365	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	170.6437	204.2999	176.2841	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												551.2277 (107)
Energy for space heating												32.9141 (99)
Energy for space cooling												3.1439 (108)
Total												36.0580 (109)
Fabric Energy Efficiency (DFEE)												36.1 (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	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 431.3118 (5)

2. Ventilation rate

	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0927 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3427	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2913 (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	0.3714	0.3642	0.3569	0.3205	0.3132	0.2768	0.2768	0.2695	0.2913	0.3132	0.3277	0.3423 (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	0.5690	0.5663	0.5637	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5537	0.5586 (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			4.1000	1.0000	4.1000		(26a)
TER Opening Type (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632		(28a)

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Floor 2 P/a 0.56 Upper			33.4500	0.1300	4.3485		(28a)
Floor 3 over garage			15.1200	0.1300	1.9656		(28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1800	19.4976		(29a)
External Wall 4 retaining	2.4800		2.4800	0.1800	0.4464		(29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1800	12.7134		(29a)
External Wall 3 Garage	12.6800		12.6800	0.1800	2.2824		(29a)
External Roof 1 Horiz	95.2200		95.2200	0.1100	10.4742		(30)
Total net area of external elements Aum(A, m2)			426.4600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		105.1966		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.9771 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	24.1200	0.0900	2.1708
E5 Ground floor (normal)	42.7800	0.1600	6.8448
E6 Intermediate floor within a dwelling	37.9400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	49.0300	0.0600	2.9418
E17 Corner (inverted - internal area greater than external area)	4.6600	-0.0900	-0.4194
E2 Other lintels (including other steel lintels)	26.7800	0.0500	1.3390
E3 Sill	24.8300	0.0500	1.2415
E4 Jamb	64.0800	0.0500	3.2040
E20 Exposed floor (normal)	11.0900	0.3200	3.5488
E21 Exposed floor (inverted)	4.8400	0.3200	1.5488
E22 Basement floor	4.9600	0.0700	0.3472
E6 Intermediate floor within a dwelling	4.9600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.7673 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 127.9639 (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	
80.9854	80.6041	80.2304	78.4750	78.1465	76.6176	76.6176	76.3345	77.2065	78.1465	78.8109	79.5055	(38)	
Heat transfer coeff	208.9493	208.5680	208.1943	206.4389	206.1105	204.5816	204.5816	204.2984	205.1705	206.1105	206.7749	207.4695	(39)
Average = Sum(39)m / 12 =												206.4373	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1917	1.1896	1.1874	1.1774	1.1756	1.1668	1.1668	1.1652	1.1702	1.1756	1.1793	1.1833	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9697	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.9505	31.4760	30.8078	29.5757	28.6532	27.6302	27.0777	27.7412	28.4637	29.5583	30.8157	31.8425	31.8425	(42b)
Hot water usage for other uses	45.0423	43.4044	41.7665	40.1286	38.4907	36.8528	36.8528	38.4907	40.1286	41.7665	43.4044	45.0423	45.0423	(42c)
Average daily hot water use (litres/day)													70.5707	(43)
Daily hot water use	76.9928	74.8804	72.5743	69.7043	67.1439	64.4830	63.9305	66.2319	68.5923	71.3248	74.2201	76.8848	76.8848	(44)
Energy content (annual)	121.9378	106.6287	111.5440	95.4217	90.3886	79.2894	77.3183	82.0089	84.5811	96.7870	105.7401	120.3830	120.3830	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	(61)
Total heat required for water heating calculated for each month	103.6471	90.6344	94.8124	81.1085	76.8303	67.3960	65.7206	69.7076	71.8940	82.2690	89.8791	102.3256	102.3256	(62)
WWHS	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)
FGHS	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	103.6471	90.6344	94.8124	81.1085	76.8303	67.3960	65.7206	69.7076	71.8940	82.2690	89.8791	102.3256	102.3256	(64)
12Total per year (kWh/year)													996.2244	(64)
Electric shower(s)	59.2707	52.8107	57.6673	55.0312	56.0638	53.4794	55.2621	56.0638	55.0312	57.6673	56.5829	59.2707	59.2707	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													674.2011	(64a)
Heat gains from water heating, kWh/month	40.7295	35.8613	38.1199	34.0349	33.2235	30.2189	30.2457	31.4428	31.7313	34.9841	36.6155	40.3991	40.3991	(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	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	148.4831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.1946	193.9655	175.1946	181.0345	175.1946	181.0345	175.1946	175.1946	181.0345	175.1946	181.0345	175.1946	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.9472	350.5474	341.4749	322.1608	297.7801	274.8657	259.5575	255.9572	265.0297	284.3439	308.7245	331.6389	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	37.8483	(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)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	(71)
Water heating gains (Table 5)	54.7439	53.3650	51.2364	47.2707	44.6553	41.9706	40.6528	42.2619	44.0712	47.0216	50.8549	54.2998	(72)
Total internal gains	644.4306	665.4228	635.4509	618.0109	585.1749	565.4157	542.9498	540.9587	557.6803	574.1050	608.1588	628.6783	(73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.5600	19.6403	0.6300	0.7000	0.7700	63.3845 (76)
South	18.8200	46.7521	0.6300	0.7000	0.7700	268.9009 (78)
West	8.4400	19.6403	0.6300	0.7000	0.7700	50.6596 (80)

Solar gains	382.9450	663.4848	928.3839	1169.8662	1317.3861	1308.0692	1261.2437	1153.0644	1013.3159	739.7226	460.9388	326.1394 (83)
Total gains	1027.3756	1328.9076	1563.8349	1787.8770	1902.5610	1873.4849	1804.1935	1694.0231	1570.9962	1313.8277	1069.0976	954.8178 (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	21.6715	21.7111	21.7501	21.9350	21.9700	22.1342	22.1342	22.1649	22.0706	21.9700	21.8994	21.8261
alpha	2.4448	2.4474	2.4500	2.4623	2.4647	2.4756	2.4756	2.4777	2.4714	2.4647	2.4600	2.4551
util living area	0.9640	0.9348	0.8927	0.8181	0.7140	0.5771	0.4498	0.4889	0.6740	0.8582	0.9430	0.9694 (86)
MIT	18.0103	18.4671	19.0557	19.7552	20.3282	20.7247	20.8931	20.8653	20.5698	19.7774	18.7578	17.9284 (87)
Th 2	19.9266	19.9283	19.9301	19.9381	19.9396	19.9466	19.9466	19.9479	19.9439	19.9396	19.9366	19.9334 (88)
util rest of house	0.9587	0.9256	0.8773	0.7914	0.6700	0.5080	0.3573	0.3964	0.6109	0.8312	0.9334	0.9649 (89)
MIT 2	17.1987	17.6483	18.2238	18.8995	19.4299	19.7752	19.8984	19.8834	19.6555	18.9374	17.9462	17.1221 (90)
Living area fraction									fLA = Living area / (4) =			0.0907 (91)
MIT	17.2723	17.7226	18.2993	18.9771	19.5113	19.8613	19.9886	19.9725	19.7384	19.0136	18.0198	17.1952 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2723	17.7226	18.2993	18.9771	19.5113	19.8613	19.9886	19.9725	19.7384	19.0136	18.0198	17.1952 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9399	0.9002	0.8478	0.7628	0.6499	0.5020	0.3612	0.3987	0.5971	0.8020	0.9095	0.9481 (94)
Useful gains	965.6608	1196.2821	1325.7570	1363.8236	1236.5164	940.4227	651.7612	675.3616	938.0594	1053.7435	972.3422	905.2198 (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	2710.5542	2674.3829	2456.5419	2080.3004	1609.9977	1076.3700	693.2427	729.8494	1156.8389	1734.1289	2257.9340	2696.1105 (97)
Space heating kWh	1298.2007	993.2838	841.3040	515.8633	277.8700	0.0000	0.0000	0.0000	0.0000	506.2067	925.6261	1332.4226 (98a)
Space heating requirement - total per year (kWh/year)												6690.7773
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	1298.2007	993.2838	841.3040	515.8633	277.8700	0.0000	0.0000	0.0000	0.0000	506.2067	925.6261	1332.4226 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6690.7773
Space heating per m2										(98c) / (4) =		38.1611 (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	1923.0668	1513.9036	1552.6682	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7448	0.8082	0.7817	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1432.2449	1223.5010	1213.6747	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2111.6396	2033.9771	1908.7358	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	489.1642	602.9942	517.1255	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	122.2911	150.7486	129.2814	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												402.3210 (107)
Energy for space heating												38.1611 (99)
Energy for space cooling												2.2947 (108)
Total												40.4557 (109)
Fabric Energy Efficiency (TFEE)												40.5 (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	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	431.3118 (5)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343	(44)
Energy content (annual)	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588	(45)
Distribution loss (46)m = 0.15 x (45)m	30.9837	27.2374	28.6091	24.4693	23.2339	20.4156	19.8123	20.9176	21.4913	24.5794	26.8736	30.5638	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9720 (55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532	(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	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532	(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	111.3961	98.9579	106.1323	95.5778	94.2174	86.5923	86.6329	89.0829	88.9767	97.1998	100.9075	110.4653	(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	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.4233	43.0091	34.9774	26.4801	19.7942	16.7111	18.0569	23.4711	31.5028	40.0001	46.6860	49.7691	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	517.8316	523.2051	509.6641	480.8370	444.4479	410.2473	387.3992	382.0257	395.5667	424.3938	460.7829	494.9835	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	(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)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	(71)
Water heating gains (Table 5)	149.7259	147.2588	142.6509	132.7469	126.6363	120.2671	116.4420	119.7350	123.5788	130.6449	140.1493	148.4749	(72)
Total internal gains	831.1616	828.6539	802.4732	755.2449	706.0592	662.4063	637.0790	640.4127	665.8292	710.2197	762.7990	808.4084	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	10.5600	19.6403	0.7600	0.7000	0.7700	76.4638 (76)							
South	18.8200	46.7521	0.7600	0.7000	0.7700	324.3884 (78)							
West	8.4400	19.6403	0.7600	0.7000	0.7700	61.1131 (80)							
Solar gains	461.9654	800.3943	1119.9552	1411.2671	1589.2277	1577.9882	1521.5004	1390.9984	1222.4128	892.3638	556.0532	393.4380	(83)
Total gains	1293.1270	1629.0482	1922.4284	2166.5120	2295.2869	2240.3945	2158.5793	2031.4110	1888.2420	1602.5835	1318.8522	1201.8464	(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)	29.0049	29.0894	29.1744	29.6071	29.6952	30.1436	30.1436	30.2350	29.9627	29.6952	29.5196	29.3460	(85)
tau	2.9337	2.9393	2.9450	2.9738	2.9797	3.0096	3.0096	3.0157	2.9975	2.9797	2.9680	2.9564	
util living area	0.9312	0.8792	0.8020	0.6867	0.5519	0.4093	0.3001	0.3304	0.5063	0.7448	0.8923	0.9420	(86)
Living	19.4851	19.8149	20.1818	20.5294	20.7436	20.8526	20.8846	20.8801	20.8093	20.4993	19.9302	19.4223	
Non living	18.3843	18.7953	19.2458	19.6681	19.9124	20.0366	20.0652	20.0642	19.9924	19.6459	18.9540	18.3121	
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	20.2250	19.8149	20.1818	20.5294	20.7436	20.8526	20.8846	20.8801	20.8093	20.4993	19.9302	19.6430	(87)
Th 2	20.1756	20.1778	20.1800	20.1911	20.1933	20.2044	20.2044	20.2066	20.1999	20.1933	20.1889	20.1845	(88)
util rest of house	0.9231	0.8663	0.7823	0.6584	0.5145	0.3632	0.2479	0.2762	0.4573	0.7136	0.8785	0.9350	(89)
MIT 2	19.4615	18.7953	19.2458	19.6681	19.9124	20.0366	20.0652	20.0642	19.9924	19.6459	18.9540	18.6495	(90)
Living area fraction	19.5307	18.8877	19.3307	19.7462	19.9878	20.1106	20.1395	20.1382	20.0665	19.7233	19.0426	18.7396	(91)
MIT	19.5307	18.8877	19.3307	19.7462	19.9878	20.1106	20.1395	20.1382	20.0665	19.7233	19.0426	18.7396	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5307	18.8877	19.3307	19.7462	19.9878	20.1106	20.1395	20.1382	20.0665	19.7233	19.0426	18.7396	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1184.4402	1372.3265	1460.1434	1390.1429	1158.0052	801.2440	525.7754	551.4988	847.4888	1111.5272	1127.6733	1105.5481	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

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Space heating kWh	2377.8224	2177.4204	1991.4877	1658.8676	1263.8128	827.8145	531.7063	559.8667	901.7123	1391.2156	1831.9639	2243.5417	(97)
Space heating requirement - total per year (kWh/year)	887.8764	541.0231	395.3201	193.4818	78.7208	0.0000	0.0000	0.0000	0.0000	208.0881	507.0892	846.6672	(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)	887.8764	541.0231	395.3201	193.4818	78.7208	0.0000	0.0000	0.0000	0.0000	208.0881	507.0892	846.6672	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3658.2668	
Space heating per m2												20.8650	(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 %)													391.9862	(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	887.8764	541.0231	395.3201	193.4818	78.7208	0.0000	0.0000	0.0000	0.0000	208.0881	507.0892	846.6672	(98)	
Space heating efficiency (main heating system 1)	391.9862	391.9862	391.9862	391.9862	391.9862	0.0000	0.0000	0.0000	0.0000	391.9862	391.9862	391.9862	(210)	
Space heating fuel (main heating system)	226.5070	138.0210	100.8505	49.3593	20.0825	0.0000	0.0000	0.0000	0.0000	53.0856	129.3640	215.9941	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532	(64)	
Efficiency of water heater (217)m	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	(216)	
Fuel for water heating, kWh/month	130.6345	115.4868	122.6789	107.9441	104.6710	94.3636	93.2080	96.9108	97.9675	109.1786	115.9993	129.2278	(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	37.3617	33.7460	37.3617	36.1565	37.3617	36.1565	37.3617	37.3617	36.1565	37.3617	36.1565	37.3617	(231)	
Lighting	42.3846	34.0025	30.6155	22.4302	17.3257	14.1553	15.8051	20.5441	26.6848	35.0118	39.5458	43.5626	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.1341	-96.5516	-152.8751	-181.0525	-197.7313	-182.5668	-179.7522	-167.1076	-142.2534	-112.8592	-70.0668	-52.0039	(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	-23.3837	-59.6090	-145.8615	-261.9951	-383.0975	-401.3265	-391.0607	-309.9621	-200.9360	-95.9670	-34.0951	-17.6816	(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													933.2641	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													198.9922	
Water heating fuel used													1318.2709	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)														
mechanical ventilation fans (SFP = 0.8360)													439.9035	(230a)
Total electricity for the above, kWh/year													439.9035	(231)
Electricity for lighting (calculated in Appendix L)													342.0680	(232)

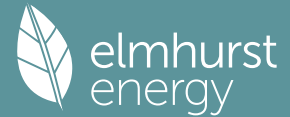
Energy saving/generation technologies (Appendices M, N and Q)

PV generation													-3921.9303	(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													-888.4237	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	933.2641	16.4900	153.8953	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1318.2709	16.4900	217.3829	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	439.9035	16.4900	72.5401	(249)
Energy for lighting	342.0680	16.4900	56.4070	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1596.9545	16.4900	-263.3378	
PV Unit electricity exported	-2324.9758	5.5900	-129.9661	
Total			-393.3039	(252)
Total energy cost			106.9213	(255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.1747 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	97.1681
SAP rating (Section 12)		97 (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	933.2641	0.1566	146.1041 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1318.2709	0.1409	185.6978 (264)
Space and water heating			331.8019 (265)
Pumps, fans and electric keep-hot	439.9035	0.1387	61.0200 (267)
Energy for lighting	342.0680	0.1443	49.3710 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1596.9545	0.1336	-213.2941
PV Unit electricity exported	-2324.9758	0.1217	-282.8759
Total			-496.1700 (269)
Total CO2, kg/year			-53.9771 (272)
CO2 emissions per m2			-0.3100 (273)
EI value			100.3283
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	431.3118 (5)

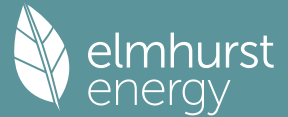
2. Ventilation rate

	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	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)										
Wind speed	Jan 6.6000	Feb 6.3000	Mar 6.2000	Apr 5.5000	May 5.4000	Jun 4.8000	Jul 4.8000	Aug 4.7000	Sep 5.2000	Oct 6.0000	Nov 6.1000	Dec 6.5000 (22)
Wind factor	1.6500	1.5750	1.5500	1.3750	1.3500	1.2000	1.2000	1.1750	1.3000	1.5000	1.5250	1.6250 (22a)
Adj infilt rate	0.2104	0.2008	0.1976	0.1753	0.1721	0.1530	0.1530	0.1498	0.1658	0.1913	0.1944	0.2072 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3054	0.2958	0.2926	0.2703	0.2671	0.2480	0.2480	0.2448	0.2607	0.2863	0.2894	0.3022 (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
Window (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Door			4.1000	1.0000	4.1000		(26a)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632	110.0000	5130.4000 (28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1200	4.0140	110.0000	3679.5000 (28a)
Floor 3 over garage			15.1200	0.1700	2.5704	20.0000	302.4000 (28b)

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External Wall 1 Render	127.1600	18.8400	108.3200	0.1700	18.4144	9.0000	974.8800	(29a)
External Wall 4 retaining	2.4800		2.4800	0.1700	0.4216	9.0000	22.3200	(29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1700	12.0071	9.0000	635.6700	(29a)
External Wall 3 Garage	12.6800		12.6800	0.1700	2.1556	18.0000	228.2400	(29a)
External Roof 1 Horz	95.2200		95.2200	0.0900	8.5698	9.0000	856.9800	(30)
Total net area of external elements Aum(A, m2)			426.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	101.6214				(33)
Internal Wall 1 GF			77.9800			9.0000	701.8200	(32c)
Internal Wall 2 TF			178.5600			9.0000	1607.0400	(32c)
Internal Floor 1			80.0900			18.0000	1441.6200	(32d)
Internal Ceiling 1			80.0900			9.0000	720.8100	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16301.6800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.9771 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.1200	0.0300	0.7236
E5 Ground floor (normal)	42.7800	0.0210	0.8984
E6 Intermediate floor within a dwelling	37.9400	0.0800	3.0352
E10 Eaves (insulation at ceiling level)	49.0300	0.0440	2.1573
E17 Corner (inverted - internal area greater than external area)	4.6600	-0.0150	-0.0699
E2 Other lintels (including other steel lintels)	26.7800	0.0840	2.2495
E3 Sill	24.8300	0.0430	1.0677
E4 Jamb	64.0800	0.0340	2.1787
E20 Exposed floor (normal)	11.0900	0.3200	3.5488
E21 Exposed floor (inverted)	4.8400	0.3200	1.5488
E22 Basement floor	4.9600	0.0210	0.1042
E6 Intermediate floor within a dwelling	4.9600	0.0800	0.3968

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8391 (36)
 Point Thermal bridges 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 119.4605 (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	43.4649	42.1038	41.6502	38.4744	38.0207	35.2986	35.2986	34.8449	37.1133	40.7428	41.1965	43.0112
Average = Sum(39)m / 12 =	162.9254	161.5644	161.1107	157.9349	157.4812	154.7591	154.7591	154.3054	156.5738	160.2033	160.6570	162.4718

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9293	0.9215	0.9189	0.9008	0.8982	0.8827	0.8827	0.8801	0.8930	0.9137	0.9163	0.9267
HLP (average)												0.9053
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9697 (42)

	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
Hot water usage for baths	85.3806	84.1126	82.3270	79.0346	76.5692	73.8356	72.3590	74.1322	76.0628	78.9879	82.3481	85.0920
Hot water usage for other uses	45.0423	43.4044	41.7665	40.1286	38.4907	36.8528	36.8528	38.4907	40.1286	41.7665	43.4044	45.0423
Average daily hot water use (litres/day)												120.1088

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343
Energy content (annual)	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588
Distribution loss (46)m = 0.15 x (45)m	30.9837	27.2374	28.6091	24.4693	23.2339	20.4156	19.8123	20.9176	21.4913	24.5794	26.8736	30.5638
Water storage loss:												250.0000
Store volume												1.8000
a) If manufacturer declared loss factor is known (kWh/day):												0.5400
Temperature factor from Table 2b												0.9720
Enter (49) or (54) in (55)												
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532
Total per year (kWh/year) = Sum(64)m =												2623.2566

Electric shower(s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000

Heat gains from water heating, kWh/month 111.3961 98.9579 106.1323 95.5778 94.2174 86.5923 86.6329 89.0829 88.9767 97.1998 100.9075 110.4653 (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	48.4233	43.0091	34.9774	26.4801	19.7942	16.7111	18.0569	23.4711	31.5028	40.0001	46.6860	49.7691
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	517.8316	523.2051	509.6641	480.8370	444.4479	410.2473	387.3992	382.0257	395.5667	424.3938	460.7829	494.9835
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865
Water heating gains (Table 5)	149.7259	147.2588	142.6509	132.7469	126.6363	120.2671	116.4420	119.7350	123.5788	130.6449	140.1493	148.4749
Total internal gains												

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831.1616 828.6539 802.4732 755.2449 706.0592 662.4063 637.0790 640.4127 665.8292 710.2197 762.7990 808.4084 (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			
East		10.5600	26.5321	0.7600		0.7000		0.7700	103.2953 (76)			
South		18.8200	58.8467	0.7600		0.7000		0.7700	408.3065 (78)			
West		8.4400	26.5321	0.7600		0.7000		0.7700	82.5580 (80)			
Solar gains	594.1598	868.9778	1203.5661	1548.5912	1644.0348	1760.7321	1511.1595	1509.0169	1342.8322	983.5434	688.8420	522.0858 (83)
Total gains	1425.3215	1697.6317	2006.0393	2303.8361	2350.0940	2423.1384	2148.2385	2149.4296	2008.6614	1693.7631	1451.6410	1330.4942 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	27.7934	28.0275	28.1064	28.6716	28.7542	29.2600	29.2600	29.3460	28.9208	28.2656	28.1858	27.8710
alpha	2.8529	2.8685	2.8738	2.9114	2.9169	2.9507	2.9507	2.9564	2.9281	2.8844	2.8791	2.8581
util living area	0.9017	0.8557	0.7787	0.6713	0.5662	0.4178	0.3677	0.3603	0.4935	0.7098	0.8480	0.9096 (86)
Living	19.6972	19.9292	20.2360	20.5297	20.7133	20.8401	20.8654	20.8680	20.8058	20.5433	20.1201	19.6932
Non living	18.6266	18.9157	19.2882	19.6459	19.8566	20.0019	20.0269	20.0313	19.9626	19.6644	19.1610	18.6251
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	20.3335	19.9292	20.2360	20.5297	20.7133	20.8401	20.8654	20.8680	20.8058	20.5433	20.1201	19.8760 (87)
Th 2	20.1427	20.1493	20.1515	20.1668	20.1690	20.1823	20.1823	20.1845	20.1734	20.1558	20.1537	20.1449 (88)
util rest of house	0.8897	0.8397	0.7563	0.6420	0.5289	0.3735	0.3150	0.3076	0.4439	0.6736	0.8279	0.8981 (89)
MIT 2	19.5383	18.9157	19.2882	19.6459	19.8566	20.0019	20.0269	20.0313	19.9626	19.6644	19.1610	18.8990 (90)
Living area fraction										fLA = Living area / (4) =		0.0907 (91)
MIT	19.6104	19.0076	19.3741	19.7260	19.9343	20.0779	20.1029	20.1072	20.0391	19.7441	19.2479	18.9876 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6104	19.0076	19.3741	19.7260	19.9343	20.0779	20.1029	20.1072	20.0391	19.7441	19.2479	18.9876 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8813	0.8146	0.7334	0.6255	0.5179	0.3677	0.3098	0.3025	0.4355	0.6543	0.8027	0.8793 (94)
Useful gains	1256.1266	1382.9276	1471.3198	1441.0535	1217.0394	890.9990	665.5102	650.2005	874.8623	1108.2582	1165.2110	1169.8394 (95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000 (96)
Heat loss rate W												
Space heating kWh	2266.3619	2101.5651	1961.3848	1709.8042	1343.9973	925.1373	681.3930	664.6252	929.9095	1352.7781	1726.7318	2093.8645 (97)
Space heating requirement - total per year (kWh/year)	751.6150	482.9244	364.6084	193.5005	94.4566	0.0000	0.0000	0.0000	0.0000	181.9228	404.2950	687.4747 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	751.6150	482.9244	364.6084	193.5005	94.4566	0.0000	0.0000	0.0000	0.0000	181.9228	404.2950	687.4747 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3160.7975
Space heating per m2										(98c) / (4) =		18.0277 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												400.1887 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	751.6150	482.9244	364.6084	193.5005	94.4566	0.0000	0.0000	0.0000	0.0000	181.9228	404.2950	687.4747 (98)
Space heating efficiency (main heating system 1)	400.1887	400.1887	400.1887	400.1887	400.1887	0.0000	0.0000	0.0000	0.0000	400.1887	400.1887	400.1887 (210)
Space heating fuel (main heating system)	187.8151	120.6742	91.1091	48.3523	23.6030	0.0000	0.0000	0.0000	0.0000	45.4593	101.0261	171.7876 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	259.9524	229.8097	244.1214	214.8004	208.2872	187.7763	185.4766	192.8451	194.9476	217.2570	230.8295	257.1532 (64)
Efficiency of water heater	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710 (216)
Fuel for water heating, kWh/month	130.4517	115.3252	122.5073	107.7931	104.5246	94.2316	93.0776	96.7753	97.8304	109.0259	115.8370	129.0470 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	37.3617	33.7460	37.3617	36.1565	37.3617	36.1565	37.3617	37.3617	36.1565	37.3617	36.1565	37.3617 (231)
Lighting	42.3846	34.0025	30.6155	22.4302	17.3257	14.1553	15.8051	20.5441	26.6848	35.0118	39.5458	43.5626 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-79.7108	-106.8147	-165.3623	-194.5936	-204.4928	-192.4924	-181.5027	-176.4855	-153.8730	-124.9905	-86.1186	-68.6706 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(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)
(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)
(233b)m	-37.3370	-73.6746	-174.7672	-314.5055	-417.3572	-477.9298	-403.3523	-362.7993	-243.9420	-119.7840	-51.2539	-29.6747	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													789.8267 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													199.2710
Water heating fuel used													1316.4267 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360) mechanical ventilation fans (SFP = 0.8360)													439.9035 (230a)
Total electricity for the above, kWh/year													439.9035 (231)
Electricity for lighting (calculated in Appendix L)													342.0680 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4441.4853 (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													-1553.2603 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	789.8267	21.5100	169.8917	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1316.4267	21.5100	283.1634	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	439.9035	21.5100	94.6232	(249)
Energy for lighting	342.0680	21.5100	73.5788	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1735.1077	21.5100	-373.2217	
PV Unit electricity exported	-2706.3776	5.5900	-151.2865	
Total			-524.5082	(252)
Total energy cost			96.7490	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	789.8267	0.1561	123.3302	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1316.4267	0.1409	185.4381	(264)
Space and water heating			308.7682	(265)
Pumps, fans and electric keep-hot	439.9035	0.1387	61.0200	(267)
Energy for lighting	342.0680	0.1443	49.3710	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1735.1077	0.1344	-233.1843	
PV Unit electricity exported	-2706.3776	0.1231	-333.2399	
Total			-566.4242	(269)
Total CO2, kg/year			-147.2649	(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	789.8267	1.5780	1246.3664	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1316.4267	1.5209	2002.1069	(278)
Space and water heating			3248.4732	(279)
Pumps, fans and electric keep-hot	439.9035	1.5128	665.4861	(281)
Energy for lighting	342.0680	1.5338	524.6754	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1735.1077	1.4967	-2596.8924	
PV Unit electricity exported	-2706.3776	0.4519	-1222.9982	
Total			-3819.8906	(283)
Total Primary energy kWh/year			618.7441	(286)

SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

Current energy efficiency rating: A 97
Current environmental impact rating: A 100

N Solar water heating

Recommended

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U Solar photovoltaic panels Already installed
 V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
 N Solar water heating + 1.0 -£ 56 -38 kg (26.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£56	0.22 kg/m ²	A 98 A 101
Total Savings	£56	0.22 kg/m²	

Potential energy efficiency rating: A 98
 Potential environmental impact rating: A 101

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

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

	Current	Potential	Saving
Electricity	£621	£554	£67
Space heating	£265	£282	-£17
Water heating	£283	£199	£84
Lighting	£74	£74	£0
Generated (PV)	-£525	-£514	-£11
Total cost of fuels	£96	£40	£56
Total cost of uses	£97	£41	£56
Delivered energy	-9 kWh/m ²	-11 kWh/m ²	2 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-1 kg/m ²	0 kg/m ²
Primary energy	4 kWh/m ²	1 kWh/m ²	2 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 431.3118 (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	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (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)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (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
Window (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Door			4.1000	1.0000	4.1000		(26a)

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Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632	110.0000	5130.4000 (28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1200	4.0140	110.0000	3679.5000 (28a)
Floor 3 over garage			15.1200	0.1700	2.5704	20.0000	302.4000 (28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1700	18.4144	9.0000	974.8800 (29a)
External Wall 4 retaining	2.4800		2.4800	0.1700	0.4216	9.0000	22.3200 (29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1700	12.0071	9.0000	635.6700 (29a)
External Wall 3 Garage	12.6800		12.6800	0.1700	2.1556	18.0000	228.2400 (29a)
External Roof 1 Horz	95.2200		95.2200	0.0900	8.5698	9.0000	856.9800 (30)
Total net area of external elements Aum(A, m2)			426.4600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		101.6214		(33)
Internal Wall 1 GF			77.9800			9.0000	701.8200 (32c)
Internal Wall 2 TF			178.5600			9.0000	1607.0400 (32c)
Internal Floor 1			80.0900			18.0000	1441.6200 (32d)
Internal Ceiling 1			80.0900			9.0000	720.8100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16301.6800 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 92.9771 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	24.1200	0.0300	0.7236
E5 Ground floor (normal)	42.7800	0.0210	0.8984
E6 Intermediate floor within a dwelling	37.9400	0.0800	3.0352
E10 Eaves (insulation at ceiling level)	49.0300	0.0440	2.1573
E17 Corner (inverted - internal area greater than external area)	4.6600	-0.0150	-0.0699
E2 Other lintels (including other steel lintels)	26.7800	0.0840	2.2495
E3 Sill	24.8300	0.0430	1.0677
E4 Jamb	64.0800	0.0340	2.1787
E20 Exposed floor (normal)	11.0900	0.3200	3.5488
E21 Exposed floor (inverted)	4.8400	0.3200	1.5488
E22 Basement floor	4.9600	0.0210	0.1042
E6 Intermediate floor within a dwelling	4.9600	0.0800	0.3968

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.8391 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 119.4605 (37)

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

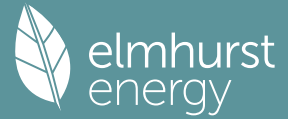
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.6596	36.2059	35.7522	33.4838	33.0301	30.7617	30.7617	30.3080	31.6691	33.0301	33.9375	34.8449 (38)
Average = Sum(39)m / 12 =	156.1201	155.6665	155.2128	152.9443	152.4907	150.2222	150.2222	149.7685	151.1296	152.4907	153.3980	154.3054 (39)
												152.8309

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8904	0.8878	0.8853	0.8723	0.8697	0.8568	0.8568	0.8542	0.8620	0.8697	0.8749	0.8801 (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												2.9697 (42)	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	85.3806	84.1126	82.3270	79.0346	76.5692	73.8356	72.3590	74.1322	76.0628	78.9879	82.3481	85.0920 (42b)	
Hot water usage for other uses	45.0423	43.4044	41.7665	40.1286	38.4907	36.8528	36.8528	38.4907	40.1286	41.7665	43.4044	45.0423 (42c)	
Average daily hot water use (litres/day)												120.1088 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343 (44)	
Energy content (annual)	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588 (45)	
Distribution loss (46)m = 0.15 x (45)m	30.9837	27.2374	28.6091	24.4693	23.2339	20.4156	19.8123	20.9176	21.4913	24.5794	26.8736	30.5638 (46)	
Water storage loss:												250.0000 (47)	
Store volume												1.8000 (48)	
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)	
Temperature factor from Table 2b												0.9720 (55)	
Enter (49) or (54) in (55)												0.9720 (55)	
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (56)	
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	259.9524	229.8097	242.7257	208.0468	195.4929	175.1696	172.4497	180.7486	189.5448	215.8612	230.8295	257.1532 (62)	
WWHS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.8000 (H2)	
Collector linear heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0000 (H4)	
Collector loop efficiency												0.9000 (H5)	
Incidence angle modifier												1.0000 (H6)	
Overshading factor												0.8000 (H8)	
Overall heat loss coefficient of system												6.5000 (H10)	
Heat loss coefficient of collector loop												3.9667 (H11)	
Dedicated solar storage volume												75.0000 (H12)	
Effective solar volume												75.0000 (H14)	
Reference volume												225.0000 (H15)	
Storage tank correction coefficient												1.3161 (H16)	
Heat delivered to hot water												616.5449 (H24)	
Heat delivered to space heating												0.0000 (H29)	
Solar input												616.5449	
Solar input	-0.0000	-16.2185	-58.0434	-79.5493	-103.5216	-95.3906	-94.7205	-83.0011	-57.4632	-28.6366	-0.0000	-0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	259.9524	213.5912	184.6822	128.4975	91.9713	79.7789	77.7292	97.7475	132.0815	187.2247	230.8295	257.1532 (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	111.3961	98.9579	105.0157	90.1749	83.9819	76.5069	76.2113	79.4057	84.6544	96.0832	100.9075	110.4653 (65)	

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.4233	43.0091	34.9774	26.4801	19.7942	16.7111	18.0569	23.4711	31.5028	40.0001	46.6860	49.7691 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	517.8316	523.2051	509.6641	480.8370	444.4479	410.2473	387.3992	382.0257	395.5667	424.3938	460.7829	494.9835 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876	55.7876 (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)	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865	-118.7865 (71)
Water heating gains (Table 5)	149.7259	147.2588	141.1501	125.2429	112.8789	106.2596	102.4346	106.7281	117.5756	129.1441	140.1493	148.4749 (72)
Total internal gains	831.1616	828.6539	800.9724	747.7409	692.3019	648.3988	623.0715	627.4057	659.8260	708.7189	762.7990	808.4084 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access Factor Table 6d	Gains W						
East	10.5600	19.6403	0.7600	0.7000	0.7700	76.4638 (76)						
South	18.8200	46.7521	0.7600	0.7000	0.7700	324.3884 (78)						
West	8.4400	19.6403	0.7600	0.7000	0.7700	61.1131 (80)						
Solar gains	461.9654	800.3943	1119.9552	1411.2671	1589.2277	1577.9882	1521.5004	1390.9984	1222.4128	892.3638	556.0532	393.4380 (83)
Total gains	1293.1270	1629.0482	1920.9276	2159.0080	2281.5296	2226.3870	2144.5719	2018.4041	1882.2388	1601.0827	1318.8522	1201.8464 (84)

7. Mean internal temperature (heating season)

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

21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	29.0049	29.0894	29.1744	29.6071	29.6952	30.1436	30.1436	30.2350	29.9627	29.6952	29.5196	29.3460
alpha	2.9337	2.9393	2.9450	2.9738	2.9797	3.0096	3.0096	3.0157	2.9975	2.9797	2.9680	2.9564
util living area	0.9312	0.8792	0.8023	0.6881	0.5544	0.4115	0.3020	0.3324	0.5076	0.7451	0.8923	0.9420 (86)
Living	19.4851	19.8149	20.1811	20.5272	20.7417	20.8519	20.8844	20.8798	20.8086	20.4988	19.9302	19.4223
Non living	18.3843	18.7953	19.2450	19.6657	19.9105	20.0360	20.0650	20.0640	19.9919	19.6453	18.9540	18.3121
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	20.2250	19.8149	20.1811	20.5272	20.7417	20.8519	20.8844	20.8798	20.8086	20.4988	19.9302	19.6430 (87)
Th 2	20.1756	20.1778	20.1800	20.1911	20.1933	20.2044	20.2044	20.2066	20.1999	20.1933	20.1889	20.1845 (88)
util rest of house	0.9231	0.8663	0.7826	0.6598	0.5169	0.3653	0.2495	0.2779	0.4586	0.7140	0.8785	0.9350 (89)
MIT 2	19.4615	18.7953	19.2450	19.6657	19.9105	20.0360	20.0650	20.0640	19.9919	19.6453	18.9540	18.6495 (90)
Living area fraction	19.5307	18.8877	19.3299	19.7438	19.9859	20.1100	20.1393	20.1380	20.0659	19.7227	19.0426	0.0907 (91)
MIT	19.5307	18.8877	19.3299	19.7438	19.9859	20.1100	20.1393	20.1380	20.0659	19.7227	19.0426	18.7396 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5307	18.8877	19.3299	19.7438	19.9859	20.1100	20.1393	20.1380	20.0659	19.7227	19.0426	18.7396 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9160	0.8424	0.7598	0.6430	0.5069	0.3597	0.2451	0.2731	0.4500	0.6939	0.8550	0.9199 (94)
Useful gains	1184.4402	1372.3265	1459.5046	1388.2555	1156.4081	800.7462	525.6482	551.3251	847.0221	1111.0473	1127.6733	1105.5481 (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	2377.8224	2177.4204	1991.3583	1658.5051	1263.5201	827.7261	531.6832	559.8353	901.6276	1391.1213	1831.9639	2243.5417 (97)
Space heating kWh	887.8764	541.0231	395.6992	194.5797	79.6913	0.0000	0.0000	0.0000	0.0000	208.3751	507.0892	846.6672 (98a)
Space heating requirement - total per year (kWh/year)												3661.0012
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	887.8764	541.0231	395.6992	194.5797	79.6913	0.0000	0.0000	0.0000	0.0000	208.3751	507.0892	846.6672 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3661.0012
Space heating per m ²										(98c) / (4) =		20.8806 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												391.9862 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	887.8764	541.0231	395.6992	194.5797	79.6913	0.0000	0.0000	0.0000	0.0000	208.3751	507.0892	846.6672 (98)
Space heating efficiency (main heating system 1)	391.9862	391.9862	391.9862	391.9862	391.9862	0.0000	0.0000	0.0000	0.0000	391.9862	391.9862	391.9862 (210)
Space heating fuel (main heating system)	226.5070	138.0210	100.9472	49.6394	20.3301	0.0000	0.0000	0.0000	0.0000	53.1588	129.3640	215.9941 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating														
Water heating requirement	259.9524	213.5912	184.6822	128.4975	91.9713	79.7789	77.7292	97.7475	132.0815	187.2247	230.8295	257.1532	257.1532	(64)
Efficiency of water heater (217)m	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	198.9922	(216)
Fuel for water heating, kWh/month	130.6345	107.3365	92.8088	64.5741	46.2185	40.0915	39.0614	49.1213	66.3752	94.0864	115.9993	129.2278	129.2278	(217)
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	44.1562	39.8830	44.1562	42.7318	44.1562	42.7318	44.1562	44.1562	42.7318	44.1562	42.7318	44.1562	44.1562	(231)
Lighting	42.3846	34.0025	30.6155	22.4302	17.3257	14.1553	15.8051	20.5441	26.6848	35.0118	39.5458	43.5626	43.5626	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-62.2156	-96.4822	-151.0961	-175.6629	-186.6259	-170.7070	-168.1030	-158.7177	-138.6981	-112.3419	-70.2050	-52.0685	-52.0685	(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	-23.3022	-59.6784	-147.6405	-267.3847	-394.2030	-413.1863	-402.7098	-318.3520	-204.4913	-96.4843	-33.9569	-17.6170	-17.6170	(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													933.9617	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													198.9922	
Water heating fuel used													975.5352	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)														
mechanical ventilation fans (SFP = 0.8360)													439.9035	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													519.9035	(231)
Electricity for lighting (calculated in Appendix L)													342.0680	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3921.9303	(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													-1150.4618	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	933.9617	16.4900	154.0103	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	975.5352	16.4900	160.8658	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	439.9035	16.4900	72.5401	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	342.0680	16.4900	56.4070	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1542.9240	16.4900	-254.4282	
PV Unit electricity exported	-2379.0063	5.5900	-132.9865	
Total			-387.4146	(252)
Total energy cost			69.6005	(255)

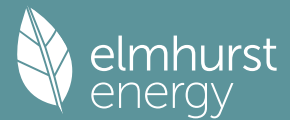
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.1137	(257)
SAP value			98.1566	
SAP rating (Section 12)			98	(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	933.9617	0.1565	146.2015	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	975.5352	0.1457	142.1239	(264)
Space and water heating			288.3254	(265)
Pumps, fans and electric keep-hot	519.9035	0.1387	72.1170	(267)
Energy for lighting	342.0680	0.1443	49.3710	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1542.9240	0.1339	-206.6589	
PV Unit electricity exported	-2379.0063	0.1215	-288.9772	
Total			-495.6360	(269)
Total CO2, kg/year			-85.8226	(272)
CO2 emissions per m2			-0.4900	(273)
EI value			100.5220	
EI rating			101	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	80.0900 (1b)	x 2.4600 (2b)	= 197.0214 (1b) - (3b)
First floor	95.2400 (1c)	x 2.4600 (2c)	= 234.2904 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.3118 (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		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1275 (21)
Wind speed	Jan 6.6000 Feb 6.3000 Mar 6.2000 Apr 5.5000 May 5.4000 Jun 4.8000 Jul 4.8000 Aug 4.7000 Sep 5.2000 Oct 6.0000 Nov 6.1000 Dec 6.5000		(22)
Wind factor	1.6500 1.5750 1.5500 1.3750 1.3500 1.2000 1.2000 1.1750 1.3000 1.5000 1.5250 1.6250		(22a)
Adj infilt rate	0.2104 0.2008 0.1976 0.1753 0.1721 0.1530 0.1530 0.1498 0.1658 0.1913 0.1944 0.2072		(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) =			81.0000 (23c)
Effective ac	0.3054 0.2958 0.2926 0.2703 0.2671 0.2480 0.2480 0.2448 0.2607 0.2863 0.2894 0.3022		(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
Window (Uw = 1.20)			37.8200	1.1450	43.3053		(27)
Door			4.1000	1.0000	4.1000		(26a)
Floor 1 P/a 0.62 lower			46.6400	0.1300	6.0632	110.0000	5130.4000 (28a)
Floor 2 P/a 0.56 Upper			33.4500	0.1200	4.0140	110.0000	3679.5000 (28a)
Floor 3 over garage			15.1200	0.1700	2.5704	20.0000	302.4000 (28b)
External Wall 1 Render	127.1600	18.8400	108.3200	0.1700	18.4144	9.0000	974.8800 (29a)
External Wall 4 retaining	2.4800		2.4800	0.1700	0.4216	9.0000	22.3200 (29a)
External Wall 2 Stone	93.7100	23.0800	70.6300	0.1700	12.0071	9.0000	635.6700 (29a)
External Wall 3 Garage	12.6800		12.6800	0.1700	2.1556	18.0000	228.2400 (29a)
External Roof 1 Horz	95.2200		95.2200	0.0900	8.5698	9.0000	856.9800 (30)
Total net area of external elements Aum(A, m ²)			426.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	101.6214		(33)
Internal Wall 1 GF			77.9800			9.0000	701.8200 (32c)
Internal Wall 2 TF			178.5600			9.0000	1607.0400 (32c)
Internal Floor 1			80.0900			18.0000	1441.6200 (32d)
Internal Ceiling 1			80.0900			9.0000	720.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16301.6800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.9771 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				24.1200	0.0300	0.7236	
E5 Ground floor (normal)				42.7800	0.0210	0.8984	
E6 Intermediate floor within a dwelling				37.9400	0.0800	3.0352	
E10 Eaves (insulation at ceiling level)				49.0300	0.0440	2.1573	
E17 Corner (inverted - internal area greater than external area)				4.6600	-0.0150	-0.0699	
E2 Other lintels (including other steel lintels)				26.7800	0.0840	2.2495	
E3 Sill				24.8300	0.0430	1.0677	
E4 Jamb				64.0800	0.0340	2.1787	
E20 Exposed floor (normal)				11.0900	0.3200	3.5488	
E21 Exposed floor (inverted)				4.8400	0.3200	1.5488	
E22 Basement floor				4.9600	0.0210	0.1042	
E6 Intermediate floor within a dwelling				4.9600	0.0800	0.3968	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.8391 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	119.4605 (37)

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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	43.4649	42.1038	41.6502	38.4744	38.0207	35.2986	35.2986	34.8449	37.1133	40.7428	41.1965	43.0112 (38)
Average = Sum(39)m / 12 =	162.9254	161.5644	161.1107	157.9349	157.4812	154.7591	154.7591	154.3054	156.5738	160.2033	160.6570	162.4718 (39) 158.7288

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9293	0.9215	0.9189	0.9008	0.8982	0.8827	0.8827	0.8801	0.8930	0.9137	0.9163	0.9267 (40) 0.9053
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9697 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												85.3806 (42b)
Hot water usage for other uses												45.0423 (42c)
Average daily hot water use (litres/day)												120.1088 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	130.4229	127.5170	124.0935	119.1632	115.0599	110.6884	109.2118	112.6229	116.1914	120.7544	125.7525	130.1343 (44)
Energy content (annual)	206.5580	181.5825	190.7270	163.1284	154.8928	136.1043	132.0822	139.4507	143.2756	163.8626	179.1575	203.7588 (45)
Distribution loss (46)m = 0.15 x (45)m												30.9837 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9720 (55)
Total storage loss												30.1320 (56)
If cylinder contains dedicated solar storage												30.1320 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												259.9524 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												714.4326 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												714.4326 (63c)
Solar input	-6.5164	-23.8217	-68.5238	-92.2152	-109.2059	-108.3903	-94.6799	-93.1388	-68.7026	-39.0100	-10.2280	-0.0000 (63d)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	253.4360	205.9880	174.2019	115.8316	86.2870	66.7793	77.7698	87.6098	120.8422	176.8513	220.6015	257.1532 (64)
Electric shower(s)												0.0000 (64a)
Heat gains from water heating, kWh/month												111.3961 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (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	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797	178.1797 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												48.4233 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												517.8316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												55.7876 (69)
Pumps, fans												0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												-118.7865 (71)
Water heating gains (Table 5)												149.7259 (72)
Total internal gains	831.1616	828.6539	800.9724	747.7409	692.3019	648.3988	623.0715	627.4057	659.8260	708.7189	762.7990	808.4084 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
East	10.5600	26.5321	0.7600	0.7000	0.7700	103.2953 (76)
South	18.8200	58.8467	0.7600	0.7000	0.7700	408.3065 (78)
West	8.4400	26.5321	0.7600	0.7000	0.7700	82.5580 (80)

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Solar gains	594.1598	868.9778	1203.5661	1548.5912	1644.0348	1760.7321	1511.1595	1509.0169	1342.8322	983.5434	688.8420	522.0858 (83)
Total gains	1425.3215	1697.6317	2004.5385	2296.3321	2336.3367	2409.1309	2134.2310	2136.4226	2002.6582	1692.2623	1451.6410	1330.4942 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.7934	28.0275	28.1064	28.6716	28.7542	29.2600	29.2600	29.3460	28.9208	28.2656	28.1858	27.8710	
alpha	2.8529	2.8685	2.8738	2.9114	2.9169	2.9507	2.9507	2.9564	2.9281	2.8844	2.8791	2.8581	
util living area	0.9017	0.8557	0.7789	0.6726	0.5687	0.4199	0.3699	0.3623	0.4947	0.7101	0.8480	0.9096 (86)	
Living	19.6972	19.9292	20.2354	20.5277	20.7112	20.8394	20.8650	20.8676	20.8052	20.5428	20.1201	19.6932	
Non living	18.6266	18.9157	19.2874	19.6436	19.8545	20.0012	20.0265	20.0310	19.9621	19.6639	19.1610	18.6251	
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	20.3335	19.9292	20.2354	20.5277	20.7112	20.8394	20.8650	20.8676	20.8052	20.5428	20.1201	19.8760 (87)	
Th 2	20.1427	20.1493	20.1515	20.1668	20.1690	20.1823	20.1823	20.1845	20.1734	20.1558	20.1537	20.1449 (88)	
util rest of house	0.8897	0.8397	0.7565	0.6434	0.5313	0.3755	0.3170	0.3094	0.4451	0.6740	0.8279	0.8981 (89)	
MIT 2	19.5383	18.9157	19.2874	19.6436	19.8545	20.0012	20.0265	20.0310	19.9621	19.6639	19.1610	18.8990 (90)	
Living area fraction	FLA = Living area / (4) = 0.0907 (91)												
MIT	19.6104	19.0076	19.3734	19.7238	19.9322	20.0773	20.1026	20.1069	20.0386	19.7436	19.2479	18.9876 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.6104	19.0076	19.3734	19.7238	19.9322	20.0773	20.1026	20.1069	20.0386	19.7436	19.2479	18.9876 (93)	

8. Space heating requirement

Utilisation	0.8813	0.8146	0.7337	0.6268	0.5202	0.3696	0.3117	0.3042	0.4366	0.6547	0.8027	0.8793 (94)
Useful gains	1256.1266	1382.9276	1470.7368	1439.2764	1215.2470	890.4263	665.1923	649.9305	874.4222	1107.8468	1165.2110	1169.8394 (95)
Ext temp.	5.7000	6.0000	7.2000	8.9000	11.4000	14.1000	15.7000	15.8000	14.1000	11.3000	8.5000	6.1000 (96)
Heat loss rate W	2266.3619	2101.5651	1961.2646	1709.4573	1343.6603	925.0339	681.3350	664.5760	929.8280	1352.6956	1726.7318	2093.8645 (97)
Space heating kWh	751.6150	482.9244	364.9526	194.5303	95.5395	0.0000	0.0000	0.0000	0.0000	182.1675	404.2950	687.4747 (98a)
Space heating requirement - total per year (kWh/year)	3163.4990											
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	751.6150	482.9244	364.9526	194.5303	95.5395	0.0000	0.0000	0.0000	0.0000	182.1675	404.2950	687.4747 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3163.4990											
Space heating per m2	(98c) / (4) = 18.0431 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	400.1887 (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	751.6150	482.9244	364.9526	194.5303	95.5395	0.0000	0.0000	0.0000	0.0000	182.1675	404.2950	687.4747 (98)
Space heating efficiency (main heating system 1)	400.1887	400.1887	400.1887	400.1887	400.1887	0.0000	0.0000	0.0000	0.0000	400.1887	400.1887	400.1887 (210)
Space heating fuel (main heating system)	187.8151	120.6742	91.1951	48.6096	23.8736	0.0000	0.0000	0.0000	0.0000	45.5204	101.0261	171.7876 (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	253.4360	205.9880	174.2019	115.8316	86.2870	66.7793	77.7698	87.6098	120.8422	176.8513	220.6015	257.1532 (64)
Efficiency of water heater (217)m	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710	199.2710 (216)
Fuel for water heating, kWh/month	127.1816	103.3708	87.4196	58.1277	43.3013	33.5118	39.0272	43.9651	60.6421	88.7491	110.7043	129.0470 (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	44.1562	39.8830	44.1562	42.7318	44.1562	42.7318	44.1562	44.1562	42.7318	44.1562	42.7318	44.1562 (231)
Lighting	42.3846	34.0025	30.6155	22.4302	17.3257	14.1553	15.8051	20.5441	26.6848	35.0118	39.5458	43.5626 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-79.7794	-106.5656	-162.7711	-187.2414	-192.0672	-177.1890	-169.6182	-165.8512	-148.7681	-123.9497	-86.1647	-68.7813 (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	-37.2685	-73.9237	-177.3583	-321.8577	-429.7828	-493.2332	-415.2369	-373.4336	-249.0469	-120.8248	-51.2079	-29.5640 (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	790.5018 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	199.2710											

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Water heating fuel used		925.0476 (219)
Space cooling fuel		0.0000 (221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)		
mechanical ventilation fans (SFP = 0.8360)		439.9035 (230a)
pump for solar water heating		80.0000 (230g)
Total electricity for the above, kWh/year		519.9035 (231)
Electricity for lighting (calculated in Appendix L)		342.0680 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-4441.4853 (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		-1863.9643 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	790.5018	21.5100	170.0369 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	925.0476	21.5100	198.9777 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	439.9035	21.5100	94.6232 (249)
Pump for solar water heating	80.0000	21.5100	17.2080 (249)
Energy for lighting	342.0680	21.5100	73.5788 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1668.7471	21.5100	-358.9475
PV Unit electricity exported	-2772.7382	5.5900	-154.9961
Total			-513.9436 (252)
Total energy cost			40.4812 (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	790.5018	0.1561	123.4242 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	925.0476	0.1461	135.1699 (264)
Space and water heating			258.5941 (265)
Pumps, fans and electric keep-hot	519.9035	0.1387	72.1170 (267)
Energy for lighting	342.0680	0.1443	49.3710 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1668.7471	0.1348	-224.9817
PV Unit electricity exported	-2772.7382	0.1229	-340.8351
Total			-565.8167 (269)
Total CO2, kg/year			-185.7346 (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	790.5018	1.5780	1247.3892 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	925.0476	1.5405	1425.0722 (278)
Space and water heating			2672.4615 (279)
Pumps, fans and electric keep-hot	519.9035	1.5128	786.5101 (281)
Energy for lighting	342.0680	1.5338	524.6754 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1668.7471	1.4983	-2500.2691
PV Unit electricity exported	-2772.7382	0.4511	-1250.8435
Total			-3751.1116 (283)
Total Primary energy kWh/year			232.5353 (286)