Full SAP Calculation Printout

Property Reference	23109	**Issued on Date**	10/11/2023
Assessment Reference	23109 Recommended	**Prop Type Ref**	
Property			

SAP Rating	90 B	**DER**	1.12	**TER**	12.60
Environmental	99 A	**% DER < TER**			91.11
CO_2 Emissions (t/year)	0.02	**DFEE**	66.74	**TFEE**	69.60
Compliance Check	See BREL	**% DFEE < TFEE**			4.11
% DPER < TPER	64.53	**DPER**	24.57	**TPER**	69.27

Assessor Details	Lee Smith	**Assessor ID**	X001-7681
Client	23109, Morris		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	150.3600	(1b)	x 3.6400	(2b) =	547.3104	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		547.3104	(5)

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2. Ventilation rate

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	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)

	Air changes per hour	
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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (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	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(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) =	74.7000 (23c)

Effective ac	0.3815	0.3765	0.3715	0.3465	0.3415	0.3165	0.3165	0.3115	0.3265	0.3415	0.3515	0.3615	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3100	3.0000	6.9300			(26)
Windows (Uw = 1.20)			14.0400	1.1450	16.0763			(27)
External Doors			13.8600	1.2000	16.6320			(26a)
North Roof Window			1.3200	1.1450	1.5115			(27a)
South Roof Window			1.3200	1.1450	1.5115			(27a)
East Roof Window			2.6400	1.1450	3.0229			(27a)
West Roof Window			1.3200	1.1450	1.5115			(27a)
Ground Floor Slab			150.3600	0.1100	16.5396	110.0000	16539.6000	(28a)
External Walls	251.8900	30.2100	221.6800	0.1700	37.6856	9.0000	1995.1200	(29a)
Stud Walls	32.2300		32.2300	0.1600	5.1568	9.0000	290.0700	(29a)
Pitched Roof (Rafter)	104.6000	6.6000	98.0000	0.1000	9.8000	9.0000	882.0000	(30)
Pitched Roof (Joists)	61.0500		61.0500	0.1100	6.7155	9.0000	549.4500	(30)
Total net area of external elements Aum(A, m2)			600.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		123.0931			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20256.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 134.7183 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	17.3000	0.0840	1.4532
E3 Sill	9.6000	0.0340	0.3264
E4 Jamb	39.6000	0.0430	1.7028
E5 Ground floor (normal)	69.2000	0.0210	1.4532
E10 Eaves (insulation at ceiling level)	24.2800	0.0170	0.4128
E11 Eaves (insulation at rafter level)	44.8200	0.0400	1.7928
E16 Corner (normal)	15.3600	0.0300	0.4608
E17 Corner (inverted - internal area greater than external area)	5.1200	-0.0150	-0.0768
R1 Head of roof window	5.5000	0.2400	1.3200
R2 Sill of roof window	5.5000	0.2400	1.3200
R3 Jamb of roof window	12.0000	0.2400	2.8800
R4 Ridge (vaulted ceiling)	36.2800	0.1200	4.3536
R5 Ridge (inverted)	5.2000	0.1200	0.6240
R8 Roof to wall (rafter)	25.4900	0.1200	3.0588

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.0816 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 144.1746 (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	68.9036	68.0006	67.0975	62.5822	61.6791	57.1638	57.1638	56.2608	58.9700	61.6791	63.4853	65.2914	(38)
Heat transfer coeff	213.0783	212.1752	211.2722	206.7569	205.8538	201.3385	201.3385	200.4354	203.1446	205.8538	207.6599	209.4660	(39)

Average = Sum(39)m / 12 = 206.5311

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4171	1.4111	1.4051	1.3751	1.3691	1.3390	1.3390	1.3330	1.3511	1.3691	1.3811	1.3931	(40)
HLP (average)												1.3736	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9347 (42)
Hot water usage for mixer showers

82.6042	81.3628	79.5539	76.0928	73.5386	70.6902	69.0712	70.8664	72.8343	75.8927	79.4281	82.2877	(42a)

Hot water usage for baths

31.6988	31.2280	30.5651	29.3427	28.4274	27.4125	26.8643	27.5226	28.2394	29.3254	30.5729	31.5916	(42b)

Hot water usage for other uses

44.6848	43.0599	41.4350	39.8101	38.1852	36.5603	36.5603	38.1852	39.8101	41.4350	43.0599	44.6848	(42c)

Average daily hot water use (litres/day) 146.1706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	158.9877	155.6507	151.5539	145.2456	140.1512	134.6630	132.4958	136.5742	140.8838	146.6530	153.0608	158.5641	(44)
Energy conte	251.7977	221.6445	232.9327	198.8339	188.6705	165.5839	160.2421	169.1074	173.7238	199.0068	218.0632	248.2730	(45)

Energy content (annual) Total = Sum(45)m = 2427.8794

Distribution loss (46)m = 0.15 x (45)m												
37.7697	33.2467	34.9399	29.8251	28.3006	24.8376	24.0363	25.3661	26.0586	29.8510	32.7095	37.2409	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.3800 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.2852 (55)
Total storage loss

39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(56)

If cylinder contains dedicated solar storage

39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(57)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

314.9013	278.6413	296.0363	259.9019	251.7741	226.6519	223.3457	232.2110	234.7918	262.1104	279.1312	311.3766	(62)
-47.5920	-42.0908	-44.0750	-36.4959	-34.0128	-29.1050	-27.2813	-29.0110	-30.1132	-35.5001	-40.2173	-46.7107	(63a)
-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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

267.3093	236.5505	251.9612	223.4060	217.7612	197.5468	196.0644	203.2001	204.6786	226.6102	238.9139	264.6659	(64)

Total per year (kWh/year) = Sum(64)m = 2728.6682 (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

134.2056	119.2942	127.9330	114.9667	113.2158	103.9110	103.7634	106.7111	106.6176	116.6526	121.3604	133.0337	(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	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.9730	69.2549	56.3219	42.6393	31.8734	26.9088	29.0760	37.7940	50.7271	64.4097	75.1756	80.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	478.9760	483.9463	471.4214	444.7573	411.0987	379.4643	358.3306	353.3604	365.8853	392.5494	426.2080	457.8423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	(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)	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	(71)
Water heating gains (Table 5)	180.3839	177.5212	171.9529	159.6759	152.1718	144.3209	139.4669	143.4289	148.0800	156.7912	168.5561	178.8087	(72)
Total internal gains	851.5711	844.9606	813.9344	761.3108	709.3821	664.9323	641.1117	648.8215	678.9305	727.9884	784.1779	831.0293	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

		W/m2	or Table 6b	or Table 6c	Table 6d		
North	1.0800	10.6334	0.6300	0.7000	1.0000	4.5580	(74)
East	3.9600	19.6403	0.6300	0.7000	1.0000	30.8691	(76)
South	1.0800	46.7521	0.6300	0.7000	1.0000	20.0404	(78)
West	7.9200	19.6403	0.6300	0.7000	1.0000	61.7381	(80)
North	1.3200	16.4057	0.6300	0.7000	1.0000	8.5951	(82)
East	2.6400	26.5306	0.6300	0.7000	1.0000	27.7992	(82)
South	1.3200	43.2567	0.6300	0.7000	1.0000	22.6625	(82)
West	1.3200	26.5306	0.6300	0.7000	1.0000	13.8996	(82)

Solar gains	190.1620	364.7080	592.9853	868.7737	1078.4449	1112.4458	1055.4559	895.6435	689.5375	429.8069	235.5472	157.5181	(83)
Total gains	1041.7331	1209.6686	1406.9198	1630.0845	1787.8270	1777.3781	1696.5676	1544.4650	1368.4681	1157.7953	1019.7252	988.5475	(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	26.4069	26.5193	26.6326	27.2143	27.3336	27.9466	27.9466	28.0725	27.6982	27.3336	27.0959	26.8623	
alpha	2.7605	2.7680	2.7755	2.8143	2.8222	2.8631	2.8631	2.8715	2.8465	2.8222	2.8064	2.7908	
util living area	0.9759	0.9628	0.9341	0.8703	0.7631	0.6134	0.4799	0.5337	0.7488	0.9104	0.9644	0.9790	(86)
Living	18.9024	19.1268	19.5180	20.0350	20.4558	20.7345	20.8356	20.8150	20.5924	20.0309	19.3890	18.8833	
Non living	17.3206	17.6074	18.1022	18.7540	19.2487	19.5610	19.6464	19.6385	19.4242	18.7677	17.9589	17.3086	
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	19.9269	19.1268	19.5180	20.0350	20.4558	20.7345	20.8356	20.8150	20.5924	20.0309	19.3890	19.1794	(87)
Th 2	19.7502	19.7548	19.7594	19.7825	19.7871	19.8104	19.8104	19.8150	19.8011	19.7871	19.7779	19.7686	(88)
util rest of house	0.9711	0.9553	0.9205	0.8428	0.7115	0.5288	0.3657	0.4183	0.6755	0.8853	0.9560	0.9748	(89)
MIT 2	18.7816	17.6074	18.1022	18.7540	19.2487	19.5610	19.6464	19.6385	19.4242	18.7677	17.9589	17.7519	(90)
Living area fraction									fLA = Living area / (4) =			0.4455	(91)
MIT	19.2918	18.2842	18.7329	19.3246	19.7864	20.0838	20.1762	20.1626	19.9446	19.3304	18.5959	18.3878	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2918	18.2842	18.7329	19.3246	19.7864	20.0838	20.1762	20.1626	19.9446	19.3304	18.5959	18.3878	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9690	0.9437	0.9063	0.8306	0.7115	0.5496	0.4026	0.4543	0.6855	0.8736	0.9452	0.9686	(94)
Useful gains	1009.4127	1141.5088	1275.1123	1353.9254	1271.9906	976.8658	683.0462	701.6169	938.0183	1011.4522	963.8538	957.5014	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3194.4293	2839.8021	2584.4641	2155.3562	1664.6197	1104.0914	720.0186	754.1564	1187.2987	1797.1940	2387.2467	2971.8655	(97)
Space heating kWh	1625.6523	1141.2530	974.1578	577.0302	292.1160	0.0000	0.0000	0.0000	0.0000	584.5919	1024.8428	1498.6869	(98a)
Space heating requirement - total per year (kWh/year)												7718.3310	
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	1625.6523	1141.2530	974.1578	577.0302	292.1160	0.0000	0.0000	0.0000	0.0000	584.5919	1024.8428	1498.6869	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7718.3310	
Space heating per m2											(98c) / (4) =	51.3323	(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 %)	355.3429 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	65.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1625.6523	1141.2530	974.1578	577.0302	292.1160	0.0000	0.0000	0.0000	0.0000	584.5919	1024.8428	1498.6869	(98)
Space heating efficiency (main heating system 1)	355.3429	355.3429	355.3429	355.3429	355.3429	0.0000	0.0000	0.0000	0.0000	355.3429	355.3429	355.3429	(210)
Space heating fuel (main heating system)	457.4883	321.1695	274.1458	162.3868	82.2068	0.0000	0.0000	0.0000	0.0000	164.5149	288.4095	421.7579	(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	267.3093	236.5505	251.9612	223.4060	217.7612	197.5468	196.0644	203.2001	204.6786	226.6102	238.9139	264.6659	(64)
Efficiency of water heater												191.8839	(216)
(217)m	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	(217)
Fuel for water heating, kWh/month	139.3078	123.2779	131.3092	116.4277	113.4859	102.9512	102.1787	105.8974	106.6680	118.0976	124.5096	137.9302	(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	51.1527	46.2025	51.1527	49.5027	51.1527	49.5027	51.1527	51.1527	49.5027	51.1527	49.5027	51.1527	(231)
Lighting	68.2493	54.7521	49.2982	36.1180	27.8986	22.7934	25.4500	33.0809	42.9688	56.3774	63.6781	70.1462	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-89.1466	-127.9390	-186.0591	-205.3611	-212.8251	-183.9194	-182.3378	-173.4513	-155.1812	-142.6300	-97.4953	-76.2516	(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	-36.0697	-81.0109	-169.8065	-271.5690	-376.3819	-395.3649	-389.2911	-325.9837	-235.9765	-124.4847	-51.0292	-28.5330	(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	2172.0796	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	191.8839	
Water heating fuel used	1422.0412	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9020)		
mechanical ventilation fans (SFP = 0.9020)	602.2823	(230a)
Total electricity for the above, kWh/year	602.2823	(231)
Electricity for lighting (calculated in Appendix L)	550.8110	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4318.0985	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	429.1156	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2172.0796	16.4900	358.1759	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1422.0412	16.4900	234.4946	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	602.2823	16.4900	99.3163	(249)
Energy for lighting	550.8110	16.4900	90.8287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1832.5976	16.4900	-302.1953	
PV Unit electricity exported	-2485.5009	5.5900	-138.9395	
Total			-441.1348	(252)
Total energy cost			341.6808	(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] =	0.6296	(257)
SAP value		89.7937	
SAP rating (Section 12)		90	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2172.0796	0.1550	336.6450	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1422.0412	0.1407	200.0661	(264)
Space and water heating			536.7111	(265)
Pumps, fans and electric keep-hot	602.2823	0.1387	83.5440	(267)
Energy for lighting	550.8110	0.1443	79.4991	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1832.5976	0.1354	-248.1447	
PV Unit electricity exported	-2485.5009	0.1238	-307.7024	
Total			-555.8471	(269)
Total CO2, kg/year			143.9071	(272)
CO2 emissions per m2			0.9600	(273)
EI value			99.0129	
EI rating			99	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	150.3600	(1b)	x 3.6400	(2b) =	547.3104	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 150.3600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		547.3104	(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)
	Air changes per hour		
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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000	(22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750	(22a)
Adj infilt rate	0.3000	0.2800	0.2800	0.2500	0.2500	0.2200	0.2200	0.2150	0.2350	0.2700	0.2750	0.2950	(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) =		74.7000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.4265	0.4065	0.4065	0.3765	0.3765	0.3465	0.3465	0.3415	0.3615	0.3965	0.4015	0.4215	(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	
Front Door			2.3100	3.0000	6.9300			(26)
Windows (Uw = 1.20)			14.0400	1.1450	16.0763			(27)
External Doors			13.8600	1.2000	16.6320			(26a)
North Roof Window			1.3200	1.1450	1.5115			(27a)
South Roof Window			1.3200	1.1450	1.5115			(27a)
East Roof Window			2.6400	1.1450	3.0229			(27a)
West Roof Window			1.3200	1.1450	1.5115			(27a)
Ground Floor Slab			150.3600	0.1100	16.5396	110.0000	16539.6000	(28a)
External Walls	251.8900	30.2100	221.6800	0.1700	37.6856	9.0000	1995.1200	(29a)
Stud Walls	32.2300		32.2300	0.1600	5.1568	9.0000	290.0700	(29a)
Pitched Roof (Rafter)	104.6000	6.6000	98.0000	0.1000	9.8000	9.0000	882.0000	(30)
Pitched Roof (Joists)	61.0500		61.0500	0.1100	6.7155	9.0000	549.4500	(30)
Total net area of external elements Aum(A, m2)			600.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		123.0931			(33)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20256.2400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.7183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	17.3000	0.0840	1.4532
E3 Sill	9.6000	0.0340	0.3264
E4 Jamb	39.6000	0.0430	1.7028
E5 Ground floor (normal)	69.2000	0.0210	1.4532
E10 Eaves (insulation at ceiling level)	24.2800	0.0170	0.4128
E11 Eaves (insulation at rafter level)	44.8200	0.0400	1.7928
E16 Corner (normal)	15.3600	0.0300	0.4608
E17 Corner (inverted - internal area greater than external area)	5.1200	-0.0150	-0.0768
R1 Head of roof window	5.5000	0.2400	1.3200
R2 Sill of roof window	5.5000	0.2400	1.3200
R3 Jamb of roof window	12.0000	0.2400	2.8800
R4 Ridge (vaulted ceiling)	36.2800	0.1200	4.3536
R5 Ridge (inverted)	5.2000	0.1200	0.6240
R8 Roof to wall (rafter)	25.4900	0.1200	3.0588

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	21.0816	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 144.1746	(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	77.0312	73.4190	73.4190	68.0006	68.0006	62.5822	62.5822	61.6791	65.2914	71.6128	72.5159	76.1281	(38)
Heat transfer coeff	221.2059	217.5936	217.5936	212.1752	212.1752	206.7569	206.7569	205.8538	209.4660	215.7875	216.6905	220.3028	(39)
Average = Sum(39)m / 12 =												213.5298	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4712	1.4472	1.4472	1.4111	1.4111	1.3751	1.3751	1.3691	1.3931	1.4351	1.4411	1.4652	(40)
HLP (average)												1.4201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9347	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.6042	81.3628	79.5539	76.0928	73.5386	70.6902	69.0712	70.8664	72.8343	75.8927	79.4281	82.2877	(42a)
Hot water usage for baths	31.6988	31.2280	30.5651	29.3427	28.4274	27.4125	26.8643	27.5226	28.2394	29.3254	30.5729	31.5916	(42b)
Hot water usage for other uses	44.6848	43.0599	41.4350	39.8101	38.1852	36.5603	36.5603	38.1852	39.8101	41.4350	43.0599	44.6848	(42c)
Average daily hot water use (litres/day)												146.1706	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	158.9877	155.6507	151.5539	145.2456	140.1512	134.6630	132.4958	136.5742	140.8838	146.6530	153.0608	158.5641	(44)
Energy conte	251.7977	221.6445	232.9327	198.8339	188.6705	165.5839	160.2421	169.1074	173.7238	199.0068	218.0632	248.2730	(45)
Energy content (annual)										Total = Sum(45)m =		2427.8794	
Distribution loss (46)m = 0.15 x (45)m													
	37.7697	33.2467	34.9399	29.8251	28.3006	24.8376	24.0363	25.3661	26.0586	29.8510	32.7095	37.2409	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.3800	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2852	(55)
Total storage loss													
	39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(56)
If cylinder contains dedicated solar storage													
	39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(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													
	314.9013	278.6413	296.0363	259.9019	251.7741	226.6519	223.3457	232.2110	234.7918	262.1104	279.1312	311.3766	(62)
WWHRS	-47.5920	-42.0908	-44.0750	-36.4959	-34.0128	-29.1050	-27.2813	-29.0110	-30.1132	-35.5001	-40.2173	-46.7107	(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													
	267.3093	236.5505	251.9612	223.4060	217.7612	197.5468	196.0644	203.2001	204.6786	226.6102	238.9139	264.6659	(64)
										Total per year (kWh/year) = Sum(64)m =		2728.6682	(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													
	134.2056	119.2942	127.9330	114.9667	113.2158	103.9110	103.7634	106.7111	106.6176	116.6526	121.3604	133.0337	(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	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.9730	69.2549	56.3219	42.6393	31.8734	26.9088	29.0760	37.7940	50.7271	64.4097	75.1756	80.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	478.9760	483.9463	471.4214	444.7573	411.0987	379.4643	358.3306	353.3604	365.8853	392.5494	426.2080	457.8423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	(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)													
	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	(71)
Water heating gains (Table 5)													
	180.3839	177.5212	171.9529	159.6759	152.1718	144.3209	139.4669	143.4289	148.0800	156.7912	168.5561	178.8087	(72)
Total internal gains													
	851.5711	844.9606	813.9344	761.3108	709.3821	664.9323	641.1117	648.8215	678.9305	727.9884	784.1779	831.0293	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	14.1962	0.6300	0.7000	1.0000	6.0852	(74)
East	3.9600	26.5726	0.6300	0.7000	1.0000	41.7649	(76)
South	1.0800	59.2009	0.6300	0.7000	1.0000	25.3766	(78)
West	7.9200	26.5726	0.6300	0.7000	1.0000	83.5297	(80)
North	1.3200	21.7354	0.6300	0.7000	1.0000	11.3874	(82)
East	2.6400	36.3064	0.6300	0.7000	1.0000	38.0424	(82)
South	1.3200	57.0722	0.6300	0.7000	1.0000	29.9006	(82)
West	1.3200	36.3064	0.6300	0.7000	1.0000	19.0212	(82)

Solar gains	255.1080	414.1526	672.3550	995.8356	1171.1896	1289.1516	1132.3404	1028.2602	802.2327	495.7507	304.6671	203.2569	(83)
Total gains	1106.6792	1259.1133	1486.2895	1757.1463	1880.5716	1954.0839	1773.4521	1677.0817	1481.1633	1223.7391	1088.8450	1034.2862	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.4366	25.8589	25.8589	26.5193	26.5193	27.2143	27.2143	27.3336	26.8623	26.0753	25.9667	25.5409	
alpha	2.6958	2.7239	2.7239	2.7680	2.7680	2.8143	2.8143	2.8222	2.7908	2.7384	2.7311	2.7027	
util living area													
	0.9643	0.9499	0.9161	0.8458	0.7442	0.5892	0.5056	0.5180	0.6985	0.8780	0.9439	0.9679	(86)
Living	19.1691	19.3516	19.6656	20.1093	20.4734	20.7389	20.8153	20.8132	20.6494	20.1797	19.6665	19.1770	
Non living	17.6333	17.8740	18.2637	18.8201	19.2398	19.5360	19.6038	19.6081	19.4513	18.9108	18.2784	17.6475	
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	20.0634	19.3516	19.6656	20.1093	20.4734	20.7389	20.8153	20.8132	20.6494	20.1797	19.6665	19.4320	(87)
Th 2	19.7092	19.7274	19.7274	19.7548	19.7548	19.7825	19.7825	19.7871	19.7686	19.7365	19.7319	19.7137	(88)
util rest of house													
	0.9563	0.9390	0.8980	0.8134	0.6888	0.5051	0.3960	0.4048	0.6130	0.8410	0.9289	0.9605	(89)
MIT 2	18.8816	17.8740	18.2637	18.8201	19.2398	19.5360	19.6038	19.6081	19.4513	18.9108	18.2784	18.0198	(90)
Living area fraction										fLA = Living area / (4) =		0.4455	(91)
MIT	19.4080	18.5322	18.8882	19.3944	19.7893	20.0719	20.1435	20.1449	19.9850	19.4760	18.8967	18.6489	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4080	18.5322	18.8882	19.3944	19.7893	20.0719	20.1435	20.1449	19.9850	19.4760	18.8967	18.6489	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9541	0.9257	0.8831	0.8025	0.6905	0.5264	0.4303	0.4402	0.6297	0.8317	0.9160	0.9525	(94)
Useful gains	1055.8997	1165.5103	1312.6014	1410.0797	1298.5732	1028.7086	763.2034	738.2682	932.6801	1017.8086	997.3681	985.1109	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	2943.8184	2639.8857	2478.0019	2141.7868	1673.9179	1152.0203	815.3462	791.4938	1127.9822	1656.3895	2144.5309	2698.4724	(97)
Space heating kWh	1404.6115	990.7803	867.0580	526.8291	279.2564	0.0000	0.0000	0.0000	0.0000	475.1042	825.9572	1274.7410	(98a)
Space heating requirement - total per year (kWh/year)												6644.3376	
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	1404.6115	990.7803	867.0580	526.8291	279.2564	0.0000	0.0000	0.0000	0.0000	475.1042	825.9572	1274.7410	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6644.3376	
Space heating per m2											(98c) / (4) =	44.1895	(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 %)	353.4770	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1404.6115	990.7803	867.0580	526.8291	279.2564	0.0000	0.0000	0.0000	0.0000	475.1042	825.9572	1274.7410	(98)
Space heating efficiency (main heating system 1)	353.4770	353.4770	353.4770	353.4770	353.4770	0.0000	0.0000	0.0000	0.0000	353.4770	353.4770	353.4770	(210)
Space heating fuel (main heating system)	397.3699	280.2955	245.2940	149.0420	79.0027	0.0000	0.0000	0.0000	0.0000	134.4088	233.6665	360.6291	(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	267.3093	236.5505	251.9612	223.4060	217.7612	197.5468	196.0644	203.2001	204.6786	226.6102	238.9139	264.6659	(64)
Efficiency of water heater												191.8871	(216)
(217)m	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	(217)
Fuel for water heating, kWh/month	139.3055	123.2759	131.3071	116.4258	113.4841	102.9495	102.1770	105.8957	106.6662	118.0956	124.5076	137.9280	(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	51.1527	46.2025	51.1527	49.5027	51.1527	49.5027	51.1527	51.1527	49.5027	51.1527	49.5027	51.1527	(231)
Lighting	68.2493	54.7521	49.2982	36.1180	27.8986	22.7934	25.4500	33.0809	42.9688	56.3774	63.6781	70.1462	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-110.6646	-137.2987	-197.7625	-217.9762	-219.4787	-194.1545	-186.8631	-183.3621	-166.4089	-152.9877	-115.6726	-92.0684	(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	-55.0134	-96.4678	-199.6979	-321.4875	-413.5051	-470.8219	-420.2558	-383.0062	-282.0892	-150.4679	-73.7276	-41.3465	(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												1879.7085	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.8871	
Water heating fuel used												1422.0179	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9020)													
mechanical ventilation fans (SFP = 0.9020)												602.2823	(230a)
Total electricity for the above, kWh/year												602.2823	(231)
Electricity for lighting (calculated in Appendix L)												550.8110	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4882.5848	(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												-427.7651	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1879.7085	21.5100	404.3253	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1422.0179	21.5100	305.8761	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	602.2823	21.5100	129.5509	(249)
Energy for lighting	550.8110	21.5100	118.4794	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1974.6980	21.5100	-424.7575	
PV Unit electricity exported	-2907.8868	5.5900	-162.5509	
Total			-587.3084	(252)

Total energy cost 370.9233 (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	1879.7085	0.1549	291.2357	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1422.0179	0.1407	200.0628	(264)
Space and water heating			491.2985	(265)
Pumps, fans and electric keep-hot	602.2823	0.1387	83.5440	(267)
Energy for lighting	550.8110	0.1443	79.4991	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1974.6980	0.1360	-268.5644	
PV Unit electricity exported	-2907.8868	0.1249	-363.1782	
Total			-631.7426	(269)
Total CO2, kg/year			22.5989	(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	1879.7085	1.5736	2957.8818	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1422.0179	1.5202	2161.7625	(278)
Space and water heating			5119.6444	(279)
Pumps, fans and electric keep-hot	602.2823	1.5128	911.1326	(281)
Energy for lighting	550.8110	1.5338	844.8523	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1974.6980	1.5027	-2967.4214	
PV Unit electricity exported	-2907.8868	0.4584	-1332.8961	
Total			-4300.3175	(283)
Total Primary energy kWh/year			2575.3118	(286)

SAP 10 EPC IMPROVEMENTS

23109 Recommended

Current energy efficiency rating: B 90
Current environmental impact rating: A 99

N Solar water heating — Recommended
U Solar photovoltaic panels — Already installed
V2 Wind turbine — Recommended

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 62	-42 kg (186.9%)
V2 Wind turbine	+ 14.1	-£ 598	-496 kg (2526.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	0.28 kg/m²	B 91	A 99
Wind turbine	£598	3.30 kg/m²	A 105	A 103
Total Savings	£660	3.58 kg/m²		

Potential energy efficiency rating: A 105
Potential environmental impact rating: A 103

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	£958	£885	£73
Space heating	£534	£551	-£18
Water heating	£306	£215	£91
Lighting	£118	£118	£0
Generated (PV)	-£587	-£576	-£11
Generated (wind)	-£0	-£598	£598
Total cost of fuels	£371	-£289	£660
Total cost of uses	£371	-£290	£660
Delivered energy	-3 kWh/m²	-29 kWh/m²	26 kWh/m²
Carbon dioxide emissions	0.0 tonnes	-0.5 tonnes	0.5 tonnes
CO2 emissions per m²	0 kg/m²	-3 kg/m²	4 kg/m²
Primary energy	17 kWh/m²	-15 kWh/m²	32 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	150.3600	(1b)	x 3.6400	(2b) =	547.3104	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		547.3104	(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)
	Air changes per hour	
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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (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	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(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) =	74.7000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3815	0.3765	0.3715	0.3465	0.3415	0.3165	0.3165	0.3115	0.3265	0.3415	0.3515	0.3615	(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	
Front Door			2.3100	3.0000	6.9300			(26)
Windows (Uw = 1.20)			14.0400	1.1450	16.0763			(27)
External Doors			13.8600	1.2000	16.6320			(26a)
North Roof Window			1.3200	1.1450	1.5115			(27a)
South Roof Window			1.3200	1.1450	1.5115			(27a)
East Roof Window			2.6400	1.1450	3.0229			(27a)
West Roof Window			1.3200	1.1450	1.5115			(27a)
Ground Floor Slab			150.3600	0.1100	16.5396	110.0000	16539.6000	(28a)
External Walls	251.8900	30.2100	221.6800	0.1700	37.6856	9.0000	1995.1200	(29a)
Stud Walls	32.2300		32.2300	0.1600	5.1568	9.0000	290.0700	(29a)
Pitched Roof (Rafter)	104.6000	6.6000	98.0000	0.1000	9.8000	9.0000	882.0000	(30)
Pitched Roof (Joists)	61.0500		61.0500	0.1100	6.7155	9.0000	549.4500	(30)
Total net area of external elements Aum(A, m2)			600.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		123.0931			(33)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20256.2400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.7183	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	17.3000	0.0840	1.4532
E3 Sill	9.6000	0.0340	0.3264
E4 Jamb	39.6000	0.0430	1.7028
E5 Ground floor (normal)	69.2000	0.0210	1.4532
E10 Eaves (insulation at ceiling level)	24.2800	0.0170	0.4128
E11 Eaves (insulation at rafter level)	44.8200	0.0400	1.7928
E16 Corner (normal)	15.3600	0.0300	0.4608
E17 Corner (inverted - internal area greater than external area)	5.1200	-0.0150	-0.0768
R1 Head of roof window	5.5000	0.2400	1.3200
R2 Sill of roof window	5.5000	0.2400	1.3200
R3 Jamb of roof window	12.0000	0.2400	2.8800
R4 Ridge (vaulted ceiling)	36.2800	0.1200	4.3536
R5 Ridge (inverted)	5.2000	0.1200	0.6240
R8 Roof to wall (rafter)	25.4900	0.1200	3.0588

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.0816 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	144.1746 (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	68.9036	68.0006	67.0975	62.5822	61.6791	57.1638	57.1638	56.2608	58.9700	61.6791	63.4853	65.2914	(38)
Heat transfer coeff	213.0783	212.1752	211.2722	206.7569	205.8538	201.3385	201.3385	200.4354	203.1446	205.8538	207.6599	209.4660	(39)
Average = Sum(39)m / 12 =												206.5311	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4171	1.4111	1.4051	1.3751	1.3691	1.3390	1.3390	1.3330	1.3511	1.3691	1.3811	1.3931	(40)
HLP (average)												1.3736	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9347	(42)
Hot water usage for mixer showers													
	82.6042	81.3628	79.5539	76.0928	73.5386	70.6902	69.0712	70.8664	72.8343	75.8927	79.4281	82.2877	(42a)
Hot water usage for baths													
	31.6988	31.2280	30.5651	29.3427	28.4274	27.4125	26.8643	27.5226	28.2394	29.3254	30.5729	31.5916	(42b)
Hot water usage for other uses													
	44.6848	43.0599	41.4350	39.8101	38.1852	36.5603	36.5603	38.1852	39.8101	41.4350	43.0599	44.6848	(42c)
Average daily hot water use (litres/day)												146.1706	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	158.9877	155.6507	151.5539	145.2456	140.1512	134.6630	132.4958	136.5742	140.8838	146.6530	153.0608	158.5641	(44)
Energy conte	251.7977	221.6445	232.9327	198.8339	188.6705	165.5839	160.2421	169.1074	173.7238	199.0068	218.0632	248.2730	(45)
Energy content (annual)										Total = Sum(45)m =		2427.8794	
Distribution loss (46)m = 0.15 x (45)m													
	37.7697	33.2467	34.9399	29.8251	28.3006	24.8376	24.0363	25.3661	26.0586	29.8510	32.7095	37.2409	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.3800	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2852	(55)
Total storage loss													
	39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(56)
If cylinder contains dedicated solar storage													
	39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(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													
	314.9013	278.6413	294.6405	253.1483	238.9797	214.0451	210.3188	220.1146	229.3889	260.7146	279.1312	311.3766	(62)
WWHRS	-47.5920	-42.0908	-44.0750	-36.4959	-34.0128	-29.1050	-27.2813	-29.0110	-30.1132	-35.5001	-40.2173	-46.7107	(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												623.8559	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												623.8559	
Solar input	-0.0000	-16.2116	-58.2763	-80.2063	-104.9221	-96.9583	-96.4823	-84.1790	-57.9386	-28.6812	-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													
	267.3093	220.3388	192.2892	136.4461	100.0447	87.9818	86.5552	106.9246	141.3371	196.5333	238.9139	264.6659	(64)
										Total per year (kWh/year) = Sum(64)m =		2039.3399	(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													
	134.2056	119.2942	126.8164	109.5638	102.9803	93.8257	93.3418	97.0339	102.2953	115.5360	121.3604	133.0337	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.9730	69.2549	56.3219	42.6393	31.8734	26.9088	29.0760	37.7940	50.7271	64.4097	75.1756	80.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	478.9760	483.9463	471.4214	444.7573	411.0987	379.4643	358.3306	353.3604	365.8853	392.5494	426.2080	457.8423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	(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)													
	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	(71)
Water heating gains (Table 5)													
	180.3839	177.5212	170.4521	152.1719	138.4144	130.3134	125.4595	130.4220	142.0768	155.2904	168.5561	178.8087	(72)
Total internal gains													
	851.5711	844.9606	812.4336	753.8068	695.6247	650.9248	627.1043	635.8146	672.9273	726.4876	784.1779	831.0293	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	1.0000	4.5580	(74)
East	3.9600	19.6403	0.6300	0.7000	1.0000	30.8691	(76)
South	1.0800	46.7521	0.6300	0.7000	1.0000	20.0404	(78)
West	7.9200	19.6403	0.6300	0.7000	1.0000	61.7381	(80)
North	1.3200	16.4057	0.6300	0.7000	1.0000	8.5951	(82)
East	2.6400	26.5306	0.6300	0.7000	1.0000	27.7992	(82)
South	1.3200	43.2567	0.6300	0.7000	1.0000	22.6625	(82)
West	1.3200	26.5306	0.6300	0.7000	1.0000	13.8996	(82)

Solar gains	190.1620	364.7080	592.9853	868.7737	1078.4449	1112.4458	1055.4559	895.6435	689.5375	429.8069	235.5472	157.5181	(83)
Total gains	1041.7331	1209.6686	1405.4190	1622.5805	1774.0696	1763.3706	1682.5601	1531.4580	1362.4649	1156.2945	1019.7252	988.5475	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

tau	26.4069	26.5193	26.6326	27.2143	27.3336	27.9466	27.9466	28.0725	27.6982	27.3336	27.0959	26.8623	
alpha	2.7605	2.7680	2.7755	2.8143	2.8222	2.8631	2.8631	2.8715	2.8465	2.8222	2.8064	2.7908	
util living area													
	0.9759	0.9628	0.9343	0.8714	0.7658	0.6166	0.4831	0.5371	0.7504	0.9107	0.9644	0.9790	(86)
Living	18.9024	19.1268	19.5171	20.0312	20.4513	20.7323	20.8346	20.8137	20.5905	20.0301	19.3890	18.8833	
Non living	17.3206	17.6074	18.1010	18.7496	19.2441	19.5592	19.6459	19.6377	19.4225	18.7667	17.9589	17.3086	
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	19.9269	19.1268	19.5171	20.0312	20.4513	20.7323	20.8346	20.8137	20.5905	20.0301	19.3890	19.1794	(87)
Th 2	19.7502	19.7548	19.7594	19.7825	19.7871	19.8104	19.8104	19.8150	19.8011	19.7871	19.7779	19.7686	(88)
util rest of house													
	0.9711	0.9553	0.9207	0.8441	0.7145	0.5320	0.3685	0.4213	0.6773	0.8856	0.9560	0.9748	(89)
MIT 2	18.7816	17.6074	18.1010	18.7496	19.2441	19.5592	19.6459	19.6377	19.4225	18.7667	17.9589	17.7519	(90)
Living area fraction										fLA = Living area / (4) =		0.4455	(91)
MIT	19.2918	18.2842	18.7318	19.3205	19.7819	20.0818	20.1754	20.1616	19.9428	19.3295	18.5959	18.3878	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2918	18.2842	18.7318	19.3205	19.7819	20.0818	20.1754	20.1616	19.9428	19.3295	18.5959	18.3878	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9690	0.9437	0.9065	0.8318	0.7142	0.5527	0.4055	0.4574	0.6871	0.8739	0.9452	0.9686	(94)
Useful gains	1009.4127	1141.5088	1274.0108	1349.6813	1267.0700	974.6250	682.2210	700.4860	936.1146	1010.4685	963.8538	957.5014	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	3194.4293	2839.8021	2584.2424	2154.5174	1663.6811	1103.6896	719.8702	753.9536	1186.9409	1796.9992	2387.2467	2971.8655	(97)
Space heating kWh													
	1625.6523	1141.2530	974.8124	579.4820	295.0786	0.0000	0.0000	0.0000	0.0000	585.1788	1024.8428	1498.6869	(98a)
Space heating requirement - total per year (kWh/year)												7724.9869	
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													
	1625.6523	1141.2530	974.8124	579.4820	295.0786	0.0000	0.0000	0.0000	0.0000	585.1788	1024.8428	1498.6869	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7724.9869	
Space heating per m2											(98c) / (4) =	51.3766	(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 %)												355.3429	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												65.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1625.6523	1141.2530	974.8124	579.4820	295.0786	0.0000	0.0000	0.0000	0.0000	585.1788	1024.8428	1498.6869	(98)
Space heating efficiency (main heating system 1)													
	355.3429	355.3429	355.3429	355.3429	355.3429	0.0000	0.0000	0.0000	0.0000	355.3429	355.3429	355.3429	(210)
Space heating fuel (main heating system)													
	457.4883	321.1695	274.3300	163.0768	83.0405	0.0000	0.0000	0.0000	0.0000	164.6800	288.4095	421.7579	(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													
	267.3093	220.3388	192.2892	136.4461	100.0447	87.9818	86.5552	106.9246	141.3371	196.5333	238.9139	264.6659	(64)
Efficiency of water heater												191.8839	(216)
(217)m	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	191.8839	(217)
Fuel for water heating, kWh/month													
	139.3078	114.8292	100.2112	71.1087	52.1382	45.8516	45.1081	55.7236	73.6576	102.4230	124.5096	137.9302	(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	57.9473	52.3395	57.9473	56.0780	57.9473	56.0780	57.9473	57.9473	56.0780	57.9473	56.0780	57.9473	(231)
Lighting	68.2493	54.7521	49.2982	36.1180	27.8986	22.7934	25.4500	33.0809	42.9688	56.3774	63.6781	70.1462	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-89.2426	-127.8554	-184.3321	-200.4282	-202.4335	-171.6221	-170.1890	-164.4257	-151.0303	-142.0572	-97.6565	-76.3321	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	-35.9737	-81.0945	-171.5335	-276.5019	-386.7734	-407.6622	-401.4398	-335.0092	-240.1274	-125.0575	-50.8680	-28.4525	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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												2173.9527	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.8839	
Water heating fuel used												1062.7988	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9020)													
mechanical ventilation fans (SFP = 0.9020)												602.2823	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												682.2823	(231)
Electricity for lighting (calculated in Appendix L)												550.8110	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4318.0985	(233)

Wind generation	-3575.5408	(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	-3423.7944	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2173.9527	16.4900	358.4848	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1062.7988	16.4900	175.2555	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	602.2823	16.4900	99.3163	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	550.8110	16.4900	90.8287	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1777.6047	16.4900	-293.1270	
PV Unit electricity exported	-2540.4938	5.5900	-142.0136	
Total			-435.1406	(252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247	
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618	
Total			-472.6865	(252)
Total energy cost			-170.7497	(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] =	-0.3146	(257)
SAP value		105.1005	
SAP rating (Section 12)		105	(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	2173.9527	0.1550	336.9044	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1062.7988	0.1453	154.4125	(264)
Space and water heating			491.3169	(265)
Pumps, fans and electric keep-hot	682.2823	0.1387	94.6410	(267)
Energy for lighting	550.8110	0.1443	79.4991	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1777.6047	0.1358	-241.4237	
PV Unit electricity exported	-2540.4938	0.1235	-313.8500	
Total			-555.2738	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801	
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915	
Total			-495.9716	(269)
Total CO2, kg/year			-385.7884	(272)
CO2 emissions per m2			-2.5700	(273)
EI value			102.6462	
EI rating			103	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	150.3600	(1b)	x 3.6400	(2b) =	547.3104	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		547.3104	(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)

													Air changes per hour	
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														4.0000 (17)
Infiltration rate														0.2000 (18)
Number of sides sheltered														0 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =		0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.0000	5.6000	5.6000	5.0000	5.0000	4.4000	4.4000	4.3000	4.7000	5.4000	5.5000	5.9000	(22)
Wind factor	1.5000	1.4000	1.4000	1.2500	1.2500	1.1000	1.1000	1.0750	1.1750	1.3500	1.3750	1.4750	(22a)
Adj infilt rate													
	0.3000	0.2800	0.2800	0.2500	0.2500	0.2200	0.2200	0.2150	0.2350	0.2700	0.2750	0.2950	(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) =	74.7000 (23c)

Effective ac	0.4265	0.4065	0.4065	0.3765	0.3765	0.3465	0.3465	0.3415	0.3615	0.3965	0.4015	0.4215	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3100	3.0000	6.9300			(26)
Windows (Uw = 1.20)			14.0400	1.1450	16.0763			(27)
External Doors			13.8600	1.2000	16.6320			(26a)
North Roof Window			1.3200	1.1450	1.5115			(27a)
South Roof Window			1.3200	1.1450	1.5115			(27a)
East Roof Window			2.6400	1.1450	3.0229			(27a)
West Roof Window			1.3200	1.1450	1.5115			(27a)
Ground Floor Slab			150.3600	0.1100	16.5396	110.0000	16539.6000	(28a)
External Walls	251.8900	30.2100	221.6800	0.1700	37.6856	9.0000	1995.1200	(29a)
Stud Walls	32.2300		32.2300	0.1600	5.1568	9.0000	290.0700	(29a)
Pitched Roof (Rafter)	104.6000	6.6000	98.0000	0.1000	9.8000	9.0000	882.0000	(30)
Pitched Roof (Joists)	61.0500		61.0500	0.1100	6.7155	9.0000	549.4500	(30)
Total net area of external elements Aum(A, m2)			600.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	123.0931			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 20256.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	134.7183 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	17.3000	0.0840	1.4532
E3 Sill	9.6000	0.0340	0.3264
E4 Jamb	39.6000	0.0430	1.7028
E5 Ground floor (normal)	69.2000	0.0210	1.4532
E10 Eaves (insulation at ceiling level)	24.2800	0.0170	0.4128
E11 Eaves (insulation at rafter level)	44.8200	0.0400	1.7928
E16 Corner (normal)	15.3600	0.0300	0.4608
E17 Corner (inverted - internal area greater than external area)	5.1200	-0.0150	-0.0768
R1 Head of roof window	5.5000	0.2400	1.3200
R2 Sill of roof window	5.5000	0.2400	1.3200
R3 Jamb of roof window	12.0000	0.2400	2.8800
R4 Ridge (vaulted ceiling)	36.2800	0.1200	4.3536
R5 Ridge (inverted)	5.2000	0.1200	0.6240
R8 Roof to wall (rafter)	25.4900	0.1200	3.0588

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	21.0816 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 144.1746 (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	77.0312	73.4190	73.4190	68.0006	68.0006	62.5822	62.5822	61.6791	65.2914	71.6128	72.5159	76.1281	(38)
Heat transfer coeff	221.2059	217.5936	217.5936	212.1752	212.1752	206.7569	206.7569	205.8538	209.4660	215.7875	216.6905	220.3028	(39)
Average = Sum(39)m / 12 =												213.5298	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4712	1.4472	1.4472	1.4111	1.4111	1.3751	1.3751	1.3691	1.3931	1.4351	1.4411	1.4652	(40)
HLP (average)												1.4201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9347 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
82.6042	81.3628	79.5539	76.0928	73.5386	70.6902	69.0712	70.8664	72.8343	75.8927	79.4281	82.2877	(42a)

Hot water usage for baths

31.6988	31.2280	30.5651	29.3427	28.4274	27.4125	26.8643	27.5226	28.2394	29.3254	30.5729	31.5916	(42b)

Hot water usage for other uses

44.6848	43.0599	41.4350	39.8101	38.1852	36.5603	36.5603	38.1852	39.8101	41.4350	43.0599	44.6848	(42c)

Average daily hot water use (litres/day)	146.1706 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	158.9877	155.6507	151.5539	145.2456	140.1512	134.6630	132.4958	136.5742	140.8838	146.6530	153.0608	158.5641	(44)
Energy conte	251.7977	221.6445	232.9327	198.8339	188.6705	165.5839	160.2421	169.1074	173.7238	199.0068	218.0632	248.2730	(45)
Energy content (annual)											Total = Sum(45)m =	2427.8794	

Distribution loss (46)m = 0.15 x (45)m

37.7697	33.2467	34.9399	29.8251	28.3006	24.8376	24.0363	25.3661	26.0586	29.8510	32.7095	37.2409	(46)

Water storage loss:	
Store volume	210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	2.3800 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.2852 (55)

Total storage loss

39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(56)

If cylinder contains dedicated solar storage

	39.8412	35.9856	39.8412	38.5560	39.8412	38.5560	39.8412	39.8412	38.5560	39.8412	38.5560	39.8412	(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													
	314.9013	278.6413	294.6405	253.1483	238.9797	214.0451	210.3188	220.1146	229.3889	260.7146	279.1312	311.3766	(62)
WWHRS	-47.5920	-42.0908	-44.0750	-36.4959	-34.0128	-29.1050	-27.2813	-29.0110	-30.1132	-35.5001	-40.2173	-46.7107	(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												746.0225	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												746.0225	
Solar input	-7.1582	-24.4934	-70.3771	-94.4164	-113.8685	-112.4916	-102.7677	-97.8668	-71.6391	-39.9806	-10.9633	-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													
	260.1511	212.0571	180.1884	122.2361	91.0984	72.4486	80.2698	93.2368	127.6367	185.2339	227.9506	264.6659	(64)
									Total per year (kWh/year) = Sum(64)m =			1917.1733	(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													
	134.2056	119.2942	126.8164	109.5638	102.9803	93.8257	93.3418	97.0339	102.2953	115.5360	121.3604	133.0337	(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	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	176.0849	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.9730	69.2549	56.3219	42.6393	31.8734	26.9088	29.0760	37.7940	50.7271	64.4097	75.1756	80.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	478.9760	483.9463	471.4214	444.7573	411.0987	379.4643	358.3306	353.3604	365.8853	392.5494	426.2080	457.8423	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	55.5432	(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)													
	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	-117.3900	(71)
Water heating gains (Table 5)													
	180.3839	177.5212	170.4521	152.1719	138.4144	130.3134	125.4595	130.4220	142.0768	155.2904	168.5561	178.8087	(72)
Total internal gains													
	851.5711	844.9606	812.4336	753.8068	695.6247	650.9248	627.1043	635.8146	672.9273	726.4876	784.1779	831.0293	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	14.1962	0.6300	0.7000	1.0000	6.0852	(74)
East	3.9600	26.5726	0.6300	0.7000	1.0000	41.7649	(76)
South	1.0800	59.2009	0.6300	0.7000	1.0000	25.3766	(78)
West	7.9200	26.5726	0.6300	0.7000	1.0000	83.5297	(80)
North	1.3200	21.7354	0.6300	0.7000	1.0000	11.3874	(82)
East	2.6400	36.3064	0.6300	0.7000	1.0000	38.0424	(82)
South	1.3200	57.0722	0.6300	0.7000	1.0000	29.9006	(82)
West	1.3200	36.3064	0.6300	0.7000	1.0000	19.0212	(82)

Solar gains	255.1080	414.1526	672.3550	995.8356	1171.1896	1289.1516	1132.3404	1028.2602	802.2327	495.7507	304.6671	203.2569	(83)
Total gains	1106.6792	1259.1133	1484.7887	1749.6423	1866.8143	1940.0764	1759.4446	1664.0748	1475.1601	1222.2383	1088.8450	1034.2862	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.4366	25.8589	25.8589	26.5193	26.5193	27.2143	27.2143	27.3336	26.8623	26.0753	25.9667	25.5409	
alpha	2.6958	2.7239	2.7239	2.7680	2.7680	2.8143	2.8143	2.8222	2.7908	2.7384	2.7311	2.7027	
util living area													
	0.9643	0.9499	0.9163	0.8469	0.7469	0.5922	0.5088	0.5212	0.7001	0.8783	0.9439	0.9679	(86)
Living	19.1691	19.3516	19.6647	20.1060	20.4692	20.7369	20.8141	20.8120	20.6480	20.1789	19.6665	19.1770	
Non living	17.6333	17.8740	18.2627	18.8163	19.2356	19.5345	19.6031	19.6074	19.4501	18.9099	18.2784	17.6475	
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	20.0634	19.3516	19.6647	20.1060	20.4692	20.7369	20.8141	20.8120	20.6480	20.1789	19.6665	19.4320	(87)
Th 2	19.7092	19.7274	19.7274	19.7548	19.7548	19.7825	19.7825	19.7871	19.7686	19.7365	19.7319	19.7137	(88)
util rest of house													
	0.9563	0.9390	0.8982	0.8147	0.6917	0.5080	0.3988	0.4076	0.6146	0.8414	0.9289	0.9605	(89)
MIT 2	18.8816	17.8740	18.2627	18.8163	19.2356	19.5345	19.6031	19.6074	19.4501	18.9099	18.2784	18.0198	(90)
Living area fraction										fLA = Living area / (4) =		0.4455	(91)
MIT	19.4080	18.5322	18.8872	19.3908	19.7852	20.0701	20.1426	20.1440	19.9837	19.4752	18.8967	18.6489	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4080	18.5322	18.8872	19.3908	19.7852	20.0701	20.1426	20.1440	19.9837	19.4752	18.8967	18.6489	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9541	0.9257	0.8833	0.8037	0.6932	0.5292	0.4332	0.4430	0.6312	0.8320	0.9160	0.9525	(94)
Useful gains	1055.8997	1165.5103	1311.5773	1406.2204	1294.0140	1026.7108	762.1471	737.2179	931.1840	1016.9499	997.3681	985.1109	(95)
Ext temp.	6.1000	6.4000	7.5000	9.3000	11.9000	14.5000	16.2000	16.3000	14.6000	11.8000	9.0000	6.4000	(96)
Heat loss rate W	2943.8184	2639.8857	2477.7915	2141.0150	1673.0361	1151.6585	815.1545	791.3031	1127.6998	1656.2147	2144.5309	2698.4724	(97)
Space heating kWh	1404.6115	990.7803	867.6634	529.0521	281.9924	0.0000	0.0000	0.0000	0.0000	475.6130	825.9572	1274.7410	(98a)
Space heating requirement - total per year (kWh/year)												6650.4109	
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	1404.6115	990.7803	867.6634	529.0521	281.9924	0.0000	0.0000	0.0000	0.0000	475.6130	825.9572	1274.7410	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6650.4109	
Space heating per m2											(98c) / (4) =	44.2299	(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 %)	353.4770	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1404.6115	990.7803	867.6634	529.0521	281.9924	0.0000	0.0000	0.0000	0.0000	475.6130	825.9572	1274.7410	(98)
Space heating efficiency (main heating system 1)	353.4770	353.4770	353.4770	353.4770	0.0000	0.0000	0.0000	0.0000	353.4770	353.4770	353.4770	353.4770	(210)
Space heating fuel (main heating system)	397.3699	280.2955	245.4653	149.6708	79.7767	0.0000	0.0000	0.0000	0.0000	134.5527	233.6665	360.6291	(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	260.1511	212.0571	180.1884	122.2361	91.0984	72.4486	80.2698	93.2368	127.6367	185.2339	227.9506	264.6659	(64)
Efficiency of water heater												191.8871	(216)
(217)m	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	191.8871	(217)
Fuel for water heating, kWh/month	135.5751	110.5114	93.9034	63.7021	47.4750	37.7558	41.8318	48.5894	66.5166	96.5328	118.7942	137.9280	(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	57.9473	52.3395	57.9473	56.0780	57.9473	56.0780	57.9473	57.9473	56.0780	57.9473	56.0780	57.9473	(231)
Lighting	68.2493	54.7521	49.2982	36.1180	27.8986	22.7934	25.4500	33.0809	42.9688	56.3774	63.6781	70.1462	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-110.7323	-137.0050	-195.1721	-211.0714	-207.2464	-177.9006	-173.1549	-171.4460	-160.3047	-151.8055	-115.7041	-92.1889	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	-54.9457	-96.7615	-202.2883	-328.3922	-425.7374	-487.0758	-433.9640	-394.9223	-288.1934	-151.6502	-73.6961	-41.2260	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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												1881.4266	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												191.8871	
Water heating fuel used												999.1155	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.9020)													
mechanical ventilation fans (SFP = 0.9020)												602.2823	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												682.2823	(231)
Electricity for lighting (calculated in Appendix L)												550.8110	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4882.5848	(233)
Wind generation												-3575.5408	(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												-4344.4901	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1881.4266	21.5100	404.6949	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	999.1155	21.5100	214.9098	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	602.2823	21.5100	129.5509	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	550.8110	21.5100	118.4794	(250)
Additional standing charges			0.0000	(251)

Energy saving/generation technologies

PV Unit electricity used in dwelling	-1903.7320	21.5100	-409.4927	
PV Unit electricity exported	-2978.8528	5.5900	-166.5179	
Total			-576.0106	(252)
Wind Turbine electricity used in dwelling	-2502.8785	21.5100	-538.3692	
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618	
Total			-598.3310	(252)
Total energy cost			-289.4986	(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	1881.4266	0.1549	291.4736	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	999.1155	0.1459	145.8036	(264)
Space and water heating			437.2772	(265)
Pumps, fans and electric keep-hot	682.2823	0.1387	94.6410	(267)
Energy for lighting	550.8110	0.1443	79.4991	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1903.7320	0.1365	-259.8423	
PV Unit electricity exported	-2978.8528	0.1246	-371.2063	
Total			-631.0486	(269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801	
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915	
Total			-495.9716	(269)
Total CO2, kg/year			-515.6030	(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	1881.4266	1.5735	2960.4801	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	999.1155	1.5398	1538.4675	(278)
Space and water heating			4498.9476	(279)
Pumps, fans and electric keep-hot	682.2823	1.5128	1032.1566	(281)
Energy for lighting	550.8110	1.5338	844.8523	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1903.7320	1.5046	-2864.2781	
PV Unit electricity exported	-2978.8528	0.4573	-1362.3080	
Total			-4226.5861	(283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546	
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612	
Total			-4336.4158	(283)
Total Primary energy kWh/year			-2187.0454	(286)