Full SAP Calculation Printout

Property Reference	4907-P635-7667-Oakrise_End	**Issued on Date**	22/04/2025
Assessment Reference	Plot XX	**Prop Type Ref**	Oakrise End (AS)
Property	Plot XX, Oakrise End (AS)		

SAP Rating	87 B	**DER**	2.90	**TER**	10.31
Environmental	97 A	**% DER < TER**			71.87
CO_2 Emissions (t/year)	0.33	**DFEE**	34.14	**TFEE**	35.25
Compliance Check	See BREL	**% DFEE < TFEE**			3.15
% DPER < TPER	43.83	**DPER**	30.34	**TPER**	54.01

Assessor Details	Mr. Mitchell Bennellick	**Assessor ID**	P635-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(22b)

Mechanical extract ventilation - decentralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.3888		(33)
Main dwelling						
E-WM-28	44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel	19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber	72.8900			9.0000	656.0100	(32c)
1F - Timber	105.3000			9.0000	947.7000	(32c)
2F - Timber	22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F	42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F	34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF	42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F	34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 18703.9500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.7754	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
E3 Sill	6.4100	0.0380	0.2436
E4 Jamb	4.2000	0.0410	0.1722
E4 Jamb	19.8000	0.0410	0.8118
E5 Ground floor (normal)	8.8000	0.0520	0.4576
E5 Ground floor (normal)	9.6800	0.0450	0.4356
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
E16 Corner (normal)	11.5000	0.0410	0.4715
P1 Party wall - Ground floor	8.8000	0.0580	0.5104
E18 Party wall between dwellings	11.5000	0.0380	0.4370
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172
R1 Head of roof window	0.5800	0.1150	0.0667
R2 Sill of roof window	0.5800	0.1130	0.0655
R3 Jamb of roof window	1.5600	0.0410	0.0640
R1 Head of roof window	1.2000	0.0130	0.0156
R2 Sill of roof window	1.2000	0.0230	0.0276
R3 Jamb of roof window	2.4200	0.0320	0.0774
E16 Corner (normal)	3.0400	0.0610	0.1854
R6 Flat ceiling	9.6800	0.0190	0.1839
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.9583	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 58.3471	(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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)
Average = Sum(39)m / 12 =												108.3552	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8636	(42)
Hot water usage for mixer showers	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
										Total per year (kWh/year) = Sum(64)m =		2786.1698	(64)
12Total per year (kWh/year)												2786	(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	114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	164.7015	182.3481	164.7015	170.1916	164.7015	170.1916	164.7015	164.7015	170.1916	164.7015	170.1916	164.7015	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(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)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains													
	669.2236	687.1392	656.8476	635.0924	602.5934	581.9654	559.4188	560.1500	577.4290	595.8938	632.3253	655.1824	(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	3.1100	10.6334	0.3100	0.0000	0.7700	7.8938	(74)
South	5.0900	46.7521	0.3100	0.0000	0.7700	56.8030	(78)
West	0.4700	19.6403	0.3100	0.0000	0.7700	2.2034	(80)
North	3.7800	10.6334	0.3500	0.0000	0.7700	10.8323	(74)
North	0.4500	15.2954	0.6400	0.7000	1.0000	2.7752	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	80.5077	138.2927	195.5258	258.1163	307.3995	314.2408	299.1144	260.2864	216.5213	154.2315	96.5623	68.8544	(83)
Total gains	749.7313	825.4320	852.3734	893.2087	909.9929	896.2062	858.5332	820.4364	793.9503	750.1254	728.8876	724.0368	(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	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area	0.9853	0.9767	0.9633	0.9263	0.8464	0.6927	0.5334	0.5757	0.7826	0.9311	0.9749	0.9873	(86)
Living	19.5448	19.7249	19.9807	20.3426	20.6772	20.9013	20.9744	20.9645	20.8283	20.4177	19.9189	19.4976	
Non living	18.8302	19.0081	19.2602	19.6110	19.9215	20.1072	20.1551	20.1502	20.0542	19.6872	19.2015	18.7835	
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	20.2556	19.7249	19.9807	20.3426	20.6772	20.9013	20.9744	20.9645	20.8283	20.4177	19.9189	19.7078	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house	0.9824	0.9721	0.9557	0.9099	0.8108	0.6250	0.4412	0.4836	0.7247	0.9126	0.9691	0.9848	(89)
MIT 2	19.4824	19.0081	19.2602	19.6110	19.9215	20.1072	20.1551	20.1502	20.0542	19.6872	19.2015	18.9768	(90)
Living area fraction									fLA = Living area / (4) =			0.1517	(91)
MIT	19.5996	19.1168	19.3695	19.7220	20.0361	20.2276	20.2794	20.2737	20.1716	19.7980	19.3103	19.0877	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5996	19.1168	19.3695	19.7220	20.0361	20.2276	20.2794	20.2737	20.1716	19.7980	19.3103	19.0877	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9648	0.9466	0.8995	0.8046	0.6304	0.4542	0.4961	0.7252	0.9027	0.9615	0.9806	(94)
Useful gains	734.7923	796.3576	806.8578	803.4807	732.1423	565.0044	389.9801	407.0330	575.7341	677.1528	700.8019	709.9831	(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	1657.7956	1540.4620	1394.4739	1172.6203	903.2641	609.7796	398.6819	419.7324	657.8882	996.6499	1323.0448	1613.1549	(97)
Space heating kWh	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98a)
Space heating requirement - total per year (kWh/year)												3374.7145	
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	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3374.7145	
Space heating per m2											(98c) / (4) =	28.1062	(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 %)	298.5716	(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	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98)
Space heating efficiency (main heating system 1)	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)	229.9999	167.4768	146.4260	89.0174	42.6412	0.0000	0.0000	0.0000	0.0000	79.6144	150.0528	225.0582	(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												
	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808 (64)
Efficiency of water heater												305.9950 (216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950 (217)
Fuel for water heating, kWh/month												
	91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932 (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	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475 (231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1130.2867 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	305.9950
Water heating fuel used	910.5279 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)	
mechanical ventilation fans (SFP = 0.1066)	39.4141 (230a)
Total electricity for the above, kWh/year	39.4141 (231)
Electricity for lighting (calculated in Appendix L)	272.9407 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2353.1694 (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	1130.2867	0.1550	175.2176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			303.6264	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Total CO2, kg/year			348.4874	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9000	(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	1130.2867	1.5739	1778.9661	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	1.5215	1385.3429	(278)
Space and water heating			3164.3090	(279)
Pumps, fans and electric keep-hot	39.4141	1.5128	59.6257	(281)
Energy for lighting	272.9407	1.5338	418.6456	(282)
Total Primary energy kWh/year			3642.5803	(286)
Dwelling Primary energy Rate (DPER)			30.3400	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000	(1b) x	2.3900	(2b) =	101.8140	(1b) - (3b)
First floor	42.6000	(1c) x	2.6700	(2c) =	113.7420	(1c) - (3c)
Second floor	34.8700	(1d) x	2.5100	(2d) =	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 303.0797 (5)

---

2. Ventilation rate

---

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1320	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3820	(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) =	0.3247	(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	0.4140	0.4059	0.3977	0.3571	0.3490	0.3084	0.3084	0.3003	0.3247	0.3490	0.3653	0.3815	(22b)
Effective ac	0.5857	0.5824	0.5791	0.5638	0.5609	0.5476	0.5476	0.5451	0.5527	0.5609	0.5667	0.5728	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.1300	1.0000	2.1300			(26)
TER Opening Type			12.4500	1.1450	14.2557			(27)
TER Roof Window			0.4500	1.1450	0.6368			(27a)
Jetfloor 150/150 Grey			42.6000	0.1300	5.5380			(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634			(29a)
Smartroof Spandrel	19.9100		19.9100	0.1800	3.5838			(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.1800	0.5310			(29a)
Wall to Voids	11.9900		11.9900	0.1800	2.1582			(29a)
500mm Mineral Wool	23.9100		23.9100	0.1100	2.6301			(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1100	1.3816			(30)
Ceiling to Voids	7.7300		7.7300	0.1100	0.8503			(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.1100	0.1595			(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6184			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000			(32)
Smartroof Spandrel			19.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.7754 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E2 Other lintels (including other steel lintels)	1.0130	0.0500	0.0507
E3 Sill	6.4100	0.0500	0.3205
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	19.8000	0.0500	0.9900
E5 Ground floor (normal)	8.8000	0.1600	1.4080
E5 Ground floor (normal)	9.6800	0.1600	1.5488
E6 Intermediate floor within a dwelling	28.1600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.6800	0.0400	0.3872
E12 Gable (insulation at ceiling level)	4.9400	0.0600	0.2964
E16 Corner (normal)	11.5000	0.0900	1.0350
P1 Party wall - Ground floor	8.8000	0.0800	0.7040
E18 Party wall between dwellings	11.5000	0.0600	0.6900
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.1200	0.5928
E6 Intermediate floor within a dwelling	8.8000	0.0000	0.0000
E13 Gable (insulation at rafter level)	5.4300	0.0800	0.4344
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0800	0.4344
R1 Head of roof window	0.5800	0.0800	0.0464
R2 Sill of roof window	0.5800	0.0600	0.0348
R3 Jamb of roof window	1.5600	0.0800	0.1248
R1 Head of roof window	1.2000	0.0800	0.0960
R2 Sill of roof window	1.2000	0.0600	0.0720
R3 Jamb of roof window	2.4200	0.0800	0.1936
E16 Corner (normal)	3.0400	0.0900	0.2736
R6 Flat ceiling	9.6800	0.0600	0.5808
R7 Flat ceiling (inverted)	2.1400	0.0400	0.0856
R7 Flat ceiling (inverted)	3.5200	0.0400	0.1408
R9 Roof to wall (flat ceiling)	2.5000	0.0400	0.1000
R9 Roof to wall (flat ceiling)	2.1400	0.0400	0.0856
R4 Ridge (vaulted ceiling)	1.2500	0.0800	0.1000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4466 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 62.0651 (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	58.5781	58.2453	57.9191	56.3870	56.1003	54.7659	54.7659	54.5188	55.2799	56.1003	56.6802	57.2865	(38)
Heat transfer coeff	120.6431	120.3104	119.9842	118.4521	118.1654	116.8310	116.8310	116.5839	117.3450	118.1654	118.7453	119.3516	(39)

Average = Sum(39)m / 12 = 118.4507

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0048	1.0020	0.9993	0.9865	0.9841	0.9730	0.9730	0.9710	0.9773	0.9841	0.9890	0.9940	(40)

HLP (average)												0.9865	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8636	(42)
Hot water usage for mixer showers													
	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths													
	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses													
	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m													
	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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													
	285.1515	252.1166	267.5282	234.2934	226.5295	203.4688	200.2532	208.5140	211.1604	236.2617	252.2271	281.9008	(62)
WWHRS	-33.0218	-29.2047	-30.5815	-25.3227	-23.5999	-20.1946	-18.9292	-20.1293	-20.8941	-24.6318	-27.9048	-32.4103	(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													
	252.1297	222.9118	236.9467	208.9707	202.9296	183.2743	181.3241	188.3847	190.2663	211.6299	224.3222	249.4905	(64)
										Total per year (kWh/year) = Sum(64)m =		2552.5806	(64)
12Total per year (kWh/year)												2553	(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													
	119.0044	105.6792	113.1447	101.3137	99.5126	91.0645	90.7757	93.5224	93.6220	102.7485	107.2767	117.9235	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	163.3936	180.9001	163.3936	168.8401	163.3936	168.8401	163.3936	163.3936	168.8401	163.3936	168.8401	163.3936	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	159.9522	157.2607	152.0762	140.7135	133.7535	126.4785	122.0104	125.7022	130.0306	138.1029	148.9954	158.4994	(72)
Total internal gains													
	677.6038	695.3794	665.2279	643.4290	610.9737	587.3020	564.7991	565.5303	582.7656	604.2741	640.6619	663.5627	(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	6.8900	10.6334	0.6300	0.7000	0.7700	22.3905	(74)
South	5.0900	46.7521	0.6300	0.7000	0.7700	72.7261	(78)
West	0.4700	19.6403	0.6300	0.7000	0.7700	2.8211	(80)
North	0.4500	15.2954	0.6300	0.7000	1.0000	2.7318	(82)

Solar gains	100.6695	172.5010	242.4914	317.4239	375.4591	382.6889	364.7271	319.1268	267.6659	192.0322	120.6744	86.1395	(83)
Total gains	778.2733	867.8804	907.7192	960.8529	986.4328	969.9909	929.5261	884.6571	850.4315	796.3063	761.3363	749.7021	(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	43.0654	43.1845	43.3019	43.8620	43.9684	44.4706	44.4706	44.5648	44.2758	43.9684	43.7537	43.5314	
alpha	3.8710	3.8790	3.8868	3.9241	3.9312	3.9647	3.9647	3.9710	3.9517	3.9312	3.9169	3.9021	
util living area													
	0.9844	0.9750	0.9602	0.9202	0.8378	0.6841	0.5281	0.5705	0.7780	0.9275	0.9734	0.9864	(86)
MIT	19.3500	19.5574	19.8510	20.2708	20.6379	20.8878	20.9691	20.9579	20.8029	20.3484	19.7930	19.3227	(87)
Th 2	20.0794	20.0817	20.0839	20.0946	20.0966	20.1059	20.1059	20.1076	20.1023	20.0966	20.0925	20.0883	(88)
util rest of house													
	0.9812	0.9699	0.9517	0.9022	0.7995	0.6128	0.4309	0.4736	0.7169	0.9076	0.9671	0.9837	(89)
MIT 2	18.1462	18.4106	18.7831	19.3121	19.7495	20.0223	20.0904	20.0849	19.9405	19.4154	18.7191	18.1175	(90)
Living area fraction											fLA = Living area / (4) =	0.1517	(91)

MIT	18.3288	18.5845	18.9451	19.4575	19.8843	20.1535	20.2237	20.2173	20.0713	19.5569	18.8820	18.3003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3288	18.5845	18.9451	19.4575	19.8843	20.1535	20.2237	20.2173	20.0713	19.5569	18.8820	18.3003	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9727	0.9587	0.9379	0.8867	0.7892	0.6169	0.4443	0.4862	0.7145	0.8927	0.9557	0.9759	(94)
Useful gains	757.0121	832.0633	851.3468	851.9661	778.5374	598.3491	412.9477	430.0996	607.6443	710.8699	727.6339	731.6371	(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	1692.4780	1646.3907	1493.2109	1250.5600	967.0990	648.8257	423.3569	445.0401	700.7047	1058.3993	1399.0542	1682.8937	(97)
Space heating kWh	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(98a)
Space heating requirement - total per year (kWh/year)												3597.7585	
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	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3597.7585	
Space heating per m2											(98c) / (4) =	29.9638	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(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)	754.0483	592.8797	517.3856	310.9292	151.9933	0.0000	0.0000	0.0000	0.0000	280.1321	523.7515	766.7768	(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	252.1297	222.9118	236.9467	208.9707	202.9296	183.2743	181.3241	188.3847	190.2663	211.6299	224.3222	249.4905	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2143	85.9929	85.5985	84.7716	83.2487	79.8000	79.8000	79.8000	79.8000	84.5101	85.7353	86.2642	(217)
Fuel for water heating, kWh/month	292.4455	259.2214	276.8119	246.5102	243.7630	229.6670	227.2231	236.0711	238.4290	250.4197	261.6452	289.2167	(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	33.9500	27.2359	24.5229	17.9665	13.8779	11.3383	12.6599	16.4558	21.3744	28.0444	31.6761	34.8935	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.4013	-59.1679	-86.1606	-98.1306	-106.8130	-99.9885	-98.7196	-92.7131	-82.2700	-68.2131	-45.7879	-35.6978	(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	-20.9735	-44.3946	-88.7716	-134.1258	-178.1531	-179.3538	-177.2810	-149.7567	-109.2845	-63.7905	-28.0957	-16.5673	(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	3897.8965	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3051.4236	(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)	273.9957	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2105.6117	(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	5203.7042	(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	3897.8965	0.2100	818.5583	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3051.4236	0.2100	640.7990	(264)
Space and water heating			1459.3572	(265)

Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.9957	0.1443	39.5460	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-915.0636	0.1343	-122.9169	
PV Unit electricity exported	-1190.5481	0.1257	-149.6688	
Total			-272.5857	(269)
Total CO2, kg/year			1238.2468	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3100	(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	3897.8965	1.1300	4404.6231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3051.4236	1.1300	3448.1087	(278)
Space and water heating			7852.7318	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.9957	1.5338	420.2637	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-915.0636	1.4964	-1369.3304	
PV Unit electricity exported	-1190.5481	0.4614	-549.3766	
Total			-1918.7070	(283)
Total Primary energy kWh/year			6484.3893	(286)
Target Primary Energy Rate (TPER)			54.0100	(287)

Full SAP Calculation Printout

Property Reference	4907-P635-7667-Oakrise_End	**Issued on Date**	22/04/2025
Assessment Reference	Plot XX	**Prop Type Ref**	Oakrise End (AS)
Property	Plot XX, Oakrise End (AS)		

SAP Rating	87 B	**DER**	2.90	**TER**	10.31
Environmental	97 A	**% DER < TER**			71.87
CO_2 Emissions (t/year)	0.33	**DFEE**	34.14	**TFEE**	35.25
Compliance Check	See BREL	**% DFEE < TFEE**			3.15
% DPER < TPER	43.83	**DPER**	30.34	**TPER**	54.01

Assessor Details	Mr. Mitchell Bennellick	**Assessor ID**	P635-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1320	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.5000	(17)
Infiltration rate		0.3570	(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) =	0.3034	(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	0.3869	0.3793	0.3717	0.3338	0.3262	0.2883	0.2883	0.2807	0.3034	0.3262	0.3414	0.3565	(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	0.5748	0.5719	0.5691	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5583	0.5636	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.3888			(33)
Main dwelling								

E-WM-28	44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel	19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber	72.8900			9.0000	656.0100	(32c)
1F - Timber	105.3000			9.0000	947.7000	(32c)
2F - Timber	22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F	42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F	34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF	42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F	34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18703.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.7754 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501	
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679	
E3 Sill	6.4100	0.0380	0.2436	
E4 Jamb	4.2000	0.0410	0.1722	
E4 Jamb	19.8000	0.0410	0.8118	
E5 Ground floor (normal)	8.8000	0.0520	0.4576	
E5 Ground floor (normal)	9.6800	0.0450	0.4356	
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282	
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098	
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371	
E16 Corner (normal)	11.5000	0.0410	0.4715	
P1 Party wall - Ground floor	8.8000	0.0580	0.5104	
E18 Party wall between dwellings	11.5000	0.0380	0.4370	
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421	
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320	
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149	
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172	
R1 Head of roof window	0.5800	0.1150	0.0667	
R2 Sill of roof window	0.5800	0.1130	0.0655	
R3 Jamb of roof window	1.5600	0.0410	0.0640	
R1 Head of roof window	1.2000	0.0130	0.0156	
R2 Sill of roof window	1.2000	0.0230	0.0276	
R3 Jamb of roof window	2.4200	0.0320	0.0774	
E16 Corner (normal)	3.0400	0.0610	0.1854	
R6 Flat ceiling	9.6800	0.0190	0.1839	
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835	
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176	
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675	
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621	
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9583 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.3471 (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	57.4930	57.2024	56.9175	55.5793	55.3290	54.1635	54.1635	53.9477	54.6124	55.3290	55.8355	56.3649	(38)
Heat transfer coeff	115.8401	115.5494	115.2645	113.9264	113.6761	112.5106	112.5106	112.2948	112.9595	113.6761	114.1825	114.7120	(39)
Average = Sum(39)m / 12 =												113.9252	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9648	0.9624	0.9600	0.9488	0.9467	0.9370	0.9370	0.9352	0.9408	0.9467	0.9510	0.9554	(40)
HLP (average)												0.9488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8636 (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

31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)

Hot water usage for other uses

43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)

Average daily hot water use (litres/day) 68.8740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.1416	73.0801	70.8295	68.0285	65.5296	62.9328	62.3934	64.6395	66.9431	69.6099	72.4356	75.0362	(44)
Energy conte	119.0060	104.0651	108.8622	93.1276	88.2155	77.3832	75.4595	80.0372	82.5475	94.4599	103.1978	117.4885	(45)
Energy content (annual)										Total = Sum(45)m =		1143.8499	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	101.1551	88.4553	92.5329	79.1585	74.9832	65.7757	64.1405	68.0316	70.1654	80.2909	87.7181	99.8653	(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	101.1551	88.4553	92.5329	79.1585	74.9832	65.7757	64.1405	68.0316	70.1654	80.2909	87.7181	99.8653	(64)
										Total per year (kWh/year) = Sum(64)m =		972.2724	(64)
12Total per year (kWh/year)												972	(64)
Electric shower(s)	57.8464	51.5416	56.2814	53.7087	54.7165	52.1942	53.9341	54.7165	53.7087	56.2814	55.2231	57.8464	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		657.9991	(64a)
Heat gains from water heating, kWh/month	39.7504	34.9992	37.2036	33.2168	32.4249	29.4925	29.5186	30.6870	30.9685	34.1431	35.7353	39.4279	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	164.7015	182.3481	164.7015	170.1916	164.7015	170.1916	164.7015	164.7015	170.1916	164.7015	170.1916	164.7015	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(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)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	53.4279	52.0822	50.0048	46.1344	43.5819	40.9618	39.6756	41.2460	43.0118	45.8913	49.6324	52.9945	(72)
Total internal gains													
	569.3875	588.6489	561.4644	547.2015	519.1100	503.1368	483.7722	482.3820	497.0984	510.3704	539.6505	556.3657	(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	3.1100	10.6334	0.3100	0.0000	0.7700	7.8938	(74)
South	5.0900	46.7521	0.3100	0.0000	0.7700	56.8030	(78)
West	0.4700	19.6403	0.3100	0.0000	0.7700	2.2034	(80)
North	3.7800	10.6334	0.3500	0.0000	0.7700	10.8323	(74)
North	0.4500	15.2954	0.6400	0.7000	1.0000	2.7752	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	80.5077	138.2927	195.5258	258.1163	307.3995	314.2408	299.1144	260.2864	216.5213	154.2315	96.5623	68.8544	(83)
Total gains	649.8952	726.9416	756.9902	805.3178	826.5095	817.3776	782.8866	742.6684	713.6197	664.6019	636.2128	625.2201	(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	44.8510	44.9638	45.0749	45.6044	45.7048	46.1782	46.1782	46.2670	45.9947	45.7048	45.5021	45.2920	
alpha	3.9901	3.9976	4.0050	4.0403	4.0470	4.0785	4.0785	4.0845	4.0663	4.0470	4.0335	4.0195	
util living area													
	0.9914	0.9856	0.9766	0.9492	0.8867	0.7492	0.5926	0.6385	0.8363	0.9550	0.9848	0.9927	(86)
MIT	19.2764	19.4709	19.7533	20.1761	20.5646	20.8550	20.9581	20.9429	20.7545	20.2649	19.7119	19.2501	(87)
Th 2	20.1128	20.1148	20.1168	20.1262	20.1279	20.1361	20.1361	20.1376	20.1330	20.1279	20.1244	20.1207	(88)
util rest of house													
	0.9896	0.9826	0.9713	0.9367	0.8563	0.6821	0.4919	0.5399	0.7837	0.9415	0.9811	0.9911	(89)
MIT 2	18.5249	18.7195	19.0009	19.4223	19.7919	20.0481	20.1189	20.1124	19.9686	19.5139	18.9672	18.5046	(90)
Living area fraction									fLA = Living area / (4) =			0.1517	(91)
MIT	18.6389	18.8335	19.1150	19.5366	19.9091	20.1705	20.2462	20.2383	20.0878	19.6278	19.0802	18.6177	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6389	18.8335	19.1150	19.5366	19.9091	20.1705	20.2462	20.2383	20.0878	19.6278	19.0802	18.6177	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9767	0.9635	0.9262	0.8473	0.6850	0.5054	0.5522	0.7805	0.9316	0.9751	0.9874	(94)
Useful gains	640.4495	710.0206	729.3670	745.9135	700.3138	559.9080	395.6961	410.1097	557.0108	619.1702	620.3557	617.3679	(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													
	1661.0204	1610.0086	1454.0638	1211.7931	933.1737	626.7417	410.2356	431.0239	676.3806	1026.2466	1367.9252	1653.8821	(97)
Space heating kWh													
	759.3048	604.7920	539.1744	335.4333	173.2478	0.0000	0.0000	0.0000	0.0000	302.8649	538.2501	771.1666	(98a)
Space heating requirement - total per year (kWh/year)												4024.2337	
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													
	759.3048	604.7920	539.1744	335.4333	173.2478	0.0000	0.0000	0.0000	0.0000	302.8649	538.2501	771.1666	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4024.2337	
Space heating per m2											(98c) / (4) =	33.5157	(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	1057.5996	832.5784	853.4403	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7169	0.8027	0.7707	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	758.2046	668.2827	657.7266	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	867.9385	831.6940	789.1649	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	79.0084	121.5780	97.7901	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	19.7521	30.3945	24.4475	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												74.5941	(107)
Energy for space heating												33.5157	(99)
Energy for space cooling												0.6213	(108)
Total												34.1370	(109)
Fabric Energy Efficiency (DFEE)												34.1	(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)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1320	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3820	(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) =	0.3247	(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	0.4140	0.4059	0.3977	0.3571	0.3490	0.3084	0.3084	0.3003	0.3247	0.3490	0.3653	0.3815	(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	0.5857	0.5824	0.5791	0.5638	0.5609	0.5476	0.5476	0.5451	0.5527	0.5609	0.5667	0.5728	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.1300	1.0000	2.1300			(26)
TER Opening Type			12.4500	1.1450	14.2557			(27)
TER Roof Window			0.4500	1.1450	0.6368			(27a)
Jetfloor 150/150 Grey			42.6000	0.1300	5.5380			(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634			(29a)
Smartroof Spandrel	19.9100		19.9100	0.1800	3.5838			(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.1800	0.5310			(29a)
Wall to Voids	11.9900		11.9900	0.1800	2.1582			(29a)
500mm Mineral Wool	23.9100		23.9100	0.1100	2.6301			(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1100	1.3816			(30)
Ceiling to Voids	7.7300		7.7300	0.1100	0.8503			(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.1100	0.1595			(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6184			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000			(32)
Smartroof Spandrel			19.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.7754 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E2 Other lintels (including other steel lintels)	1.0130	0.0500	0.0507
E3 Sill	6.4100	0.0500	0.3205
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	19.8000	0.0500	0.9900
E5 Ground floor (normal)	8.8000	0.1600	1.4080
E5 Ground floor (normal)	9.6800	0.1600	1.5488
E6 Intermediate floor within a dwelling	28.1600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.6800	0.0400	0.3872
E12 Gable (insulation at ceiling level)	4.9400	0.0600	0.2964
E16 Corner (normal)	11.5000	0.0900	1.0350
P1 Party wall - Ground floor	8.8000	0.0800	0.7040
E18 Party wall between dwellings	11.5000	0.0600	0.6900
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.1200	0.5928
E6 Intermediate floor within a dwelling	8.8000	0.0000	0.0000
E13 Gable (insulation at rafter level)	5.4300	0.0800	0.4344
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0800	0.4344
R1 Head of roof window	0.5800	0.0800	0.0464
R2 Sill of roof window	0.5800	0.0600	0.0348
R3 Jamb of roof window	1.5600	0.0800	0.1248
R1 Head of roof window	1.2000	0.0800	0.0960
R2 Sill of roof window	1.2000	0.0600	0.0720

R3 Jamb of roof window	2.4200	0.0800	0.1936		
E16 Corner (normal)	3.0400	0.0900	0.2736		
R6 Flat ceiling	9.6800	0.0600	0.5808		
R7 Flat ceiling (inverted)	2.1400	0.0400	0.0856		
R7 Flat ceiling (inverted)	3.5200	0.0400	0.1408		
R9 Roof to wall (flat ceiling)	2.5000	0.0400	0.1000		
R9 Roof to wall (flat ceiling)	2.1400	0.0400	0.0856		
R4 Ridge (vaulted ceiling)	1.2500	0.0800	0.1000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				11.4466	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	62.0651	(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	58.5781	58.2453	57.9191	56.3870	56.1003	54.7659	54.7659	54.5188	55.2799	56.1003	56.6802	57.2865	(38)
Heat transfer coeff	120.6431	120.3104	119.9842	118.4521	118.1654	116.8310	116.8310	116.5839	117.3450	118.1654	118.7453	119.3516	(39)
Average = Sum(39)m / 12 =												118.4507	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0048	1.0020	0.9993	0.9865	0.9841	0.9730	0.9730	0.9710	0.9773	0.9841	0.9890	0.9940	(40)
HLP (average)												0.9865	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8636 (42)

Hot water usage for mixer showers

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	(42a)

Hot water usage for baths

31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)

Hot water usage for other uses

43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)

Average daily hot water use (litres/day) 68.8740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.1416	73.0801	70.8295	68.0285	65.5296	62.9328	62.3934	64.6395	66.9431	69.6099	72.4356	75.0362	(44)
Energy conte	119.0060	104.0651	108.8622	93.1276	88.2155	77.3832	75.4595	80.0372	82.5475	94.4599	103.1978	117.4885	(45)
Energy content (annual)										Total = Sum(45)m =		1143.8499	

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

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

101.1551	88.4553	92.5329	79.1585	74.9832	65.7757	64.1405	68.0316	70.1654	80.2909	87.7181	99.8653	(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

101.1551	88.4553	92.5329	79.1585	74.9832	65.7757	64.1405	68.0316	70.1654	80.2909	87.7181	99.8653	(64)
								Total per year (kWh/year) = Sum(64)m =			972.2724	(64)
12Total per year (kWh/year)											972	(64)

Electric shower(s)

57.8464	51.5416	56.2814	53.7087	54.7165	52.1942	53.9341	54.7165	53.7087	56.2814	55.2231	57.8464	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					657.9991	(64a)

Heat gains from water heating, kWh/month

39.7504	34.9992	37.2036	33.2168	32.4249	29.4925	29.5186	30.6870	30.9685	34.1431	35.7353	39.4279	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	163.3936	180.9001	163.3936	168.8401	163.3936	168.8401	163.3936	163.3936	168.8401	163.3936	168.8401	163.3936	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(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)	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)	53.4279	52.0822	50.0048	46.1344	43.5819	40.9618	39.6756	41.2460	43.0118	45.8913	49.6324	52.9945	(72)
Total internal gains	568.0796	587.2008	560.1565	545.8500	517.8021	501.7853	482.4643	481.0741	495.7469	509.0625	538.2989	555.0578	(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	6.8900	10.6334	0.6300	0.7000	0.7700	22.3905	(74)
South	5.0900	46.7521	0.6300	0.7000	0.7700	72.7261	(78)
West	0.4700	19.6403	0.6300	0.7000	0.7700	2.8211	(80)
North	0.4500	15.2954	0.6300	0.7000	1.0000	2.7318	(82)

Solar gains	100.6695	172.5010	242.4914	317.4239	375.4591	382.6889	364.7271	319.1268	267.6659	192.0322	120.6744	86.1395	(83)
Total gains	668.7491	759.7019	802.6479	863.2739	893.2612	884.4741	847.1913	800.2009	763.4128	701.0946	658.9733	641.1972	(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	43.0654	43.1845	43.3019	43.8620	43.9684	44.4706	44.4706	44.5648	44.2758	43.9684	43.7537	43.5314	
alpha	3.8710	3.8790	3.8868	3.9241	3.9312	3.9647	3.9647	3.9710	3.9517	3.9312	3.9169	3.9021	
util living area	0.9906	0.9837	0.9727	0.9407	0.8705	0.7267	0.5709	0.6179	0.8208	0.9495	0.9833	0.9920	(86)
MIT	19.2130	19.4267	19.7308	20.1751	20.5730	20.8600	20.9594	20.9442	20.7563	20.2516	19.6695	19.1856	(87)
Th 2	20.0794	20.0817	20.0839	20.0946	20.0966	20.1059	20.1059	20.1076	20.1023	20.0966	20.0925	20.0883	(88)
util rest of house	0.9886	0.9803	0.9666	0.9263	0.8368	0.6566	0.4691	0.5176	0.7647	0.9345	0.9792	0.9903	(89)
MIT 2	18.4374	18.6510	18.9537	19.3956	19.7714	20.0226	20.0896	20.0835	19.9418	19.4760	18.9014	18.4167	(90)

Living area fraction fLA = Living area / (4) = 0.1517 (91)

MIT	18.5550	18.7687	19.0716	19.5138	19.8930	20.1496	20.2215	20.2140	20.0653	19.5936	19.0179	18.5333	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5550	18.7687	19.0716	19.5138	19.8930	20.1496	20.2215	20.2140	20.0653	19.5936	19.0179	18.5333	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9737	0.9578	0.9150	0.8280	0.6604	0.4830	0.5304	0.7621	0.9239	0.9726	0.9863	(94)
Useful gains	658.0864	739.7115	768.7562	789.8720	739.5904	584.0765	409.1608	424.4025	581.7691	647.7327	640.9124	632.4162	(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	1719.7687	1668.5454	1508.3877	1257.2277	968.1239	648.3636	423.1083	444.6550	700.0012	1062.7360	1415.1928	1710.7020	(97)
Space heating kWh	789.8917	624.1764	550.2858	336.4961	170.0289	0.0000	0.0000	0.0000	0.0000	308.7625	557.4819	802.2447	(98a)

Space heating requirement - total per year (kWh/year) 4139.3680

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	789.8917	624.1764	550.2858	336.4961	170.0289	0.0000	0.0000	0.0000	0.0000	308.7625	557.4819	802.2447	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 4139.3680

Space heating per m2 (98c) / (4) = 34.4746 (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	1098.2113	864.5493	886.0375	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7360	0.8178	0.7857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	808.2867	707.0316	696.1649	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.8970	908.3238	857.8259	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	100.5194	149.7615	120.2758	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	25.1299	37.4404	30.0689	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 92.6392 (107)

Energy for space heating 34.4746 (99)

Energy for space cooling 0.7715 (108)

Total 35.2462 (109)

Fabric Energy Efficiency (TFEE) 35.2 (109)

Full SAP Calculation Printout

Property Reference	4907-P635-7667-Oakrise_End	**Issued on Date**	22/04/2025
Assessment Reference	Plot XX	**Prop Type Ref**	Oakrise End (AS)
Property	Plot XX, Oakrise End (AS)		

SAP Rating	87 B	**DER**	2.90	**TER**	10.31
Environmental	97 A	**% DER < TER**			71.87
CO_2 Emissions (t/year)	0.33	**DFEE**	34.14	**TFEE**	35.25
Compliance Check	See BREL	**% DFEE < TFEE**			3.15
% DPER < TPER	43.83	**DPER**	30.34	**TPER**	54.01

Assessor Details	Mr. Mitchell Bennellick	**Assessor ID**	P635-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(22b)

Mechanical extract ventilation - decentralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.3888		(33)
Main dwelling						
E-WM-28	44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel	19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber	72.8900			9.0000	656.0100	(32c)
1F - Timber	105.3000			9.0000	947.7000	(32c)
2F - Timber	22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F	42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F	34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF	42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F	34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 18703.9500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.7754	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
E3 Sill	6.4100	0.0380	0.2436
E4 Jamb	4.2000	0.0410	0.1722
E4 Jamb	19.8000	0.0410	0.8118
E5 Ground floor (normal)	8.8000	0.0520	0.4576
E5 Ground floor (normal)	9.6800	0.0450	0.4356
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
E16 Corner (normal)	11.5000	0.0410	0.4715
P1 Party wall - Ground floor	8.8000	0.0580	0.5104
E18 Party wall between dwellings	11.5000	0.0380	0.4370
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172
R1 Head of roof window	0.5800	0.1150	0.0667
R2 Sill of roof window	0.5800	0.1130	0.0655
R3 Jamb of roof window	1.5600	0.0410	0.0640
R1 Head of roof window	1.2000	0.0130	0.0156
R2 Sill of roof window	1.2000	0.0230	0.0276
R3 Jamb of roof window	2.4200	0.0320	0.0774
E16 Corner (normal)	3.0400	0.0610	0.1854
R6 Flat ceiling	9.6800	0.0190	0.1839
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.9583	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 58.3471	(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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)
Average = Sum(39)m / 12 =												108.3552	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8636	(42)
Hot water usage for mixer showers	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
										Total per year (kWh/year) = Sum(64)m =		2786.1698	(64)
12Total per year (kWh/year)												2786	(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	114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	164.7015	182.3481	164.7015	170.1916	164.7015	170.1916	164.7015	164.7015	170.1916	164.7015	170.1916	164.7015	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(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)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains													
	669.2236	687.1392	656.8476	635.0924	602.5934	581.9654	559.4188	560.1500	577.4290	595.8938	632.3253	655.1824	(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	3.1100	10.6334	0.3100	0.0000	0.7700	7.8938	(74)
South	5.0900	46.7521	0.3100	0.0000	0.7700	56.8030	(78)
West	0.4700	19.6403	0.3100	0.0000	0.7700	2.2034	(80)
North	3.7800	10.6334	0.3500	0.0000	0.7700	10.8323	(74)
North	0.4500	15.2954	0.6400	0.7000	1.0000	2.7752	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	80.5077	138.2927	195.5258	258.1163	307.3995	314.2408	299.1144	260.2864	216.5213	154.2315	96.5623	68.8544	(83)
Total gains	749.7313	825.4320	852.3734	893.2087	909.9929	896.2062	858.5332	820.4364	793.9503	750.1254	728.8876	724.0368	(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	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area	0.9853	0.9767	0.9633	0.9263	0.8464	0.6927	0.5334	0.5757	0.7826	0.9311	0.9749	0.9873	(86)
Living	19.5448	19.7249	19.9807	20.3426	20.6772	20.9013	20.9744	20.9645	20.8283	20.4177	19.9189	19.4976	
Non living	18.8302	19.0081	19.2602	19.6110	19.9215	20.1072	20.1551	20.1502	20.0542	19.6872	19.2015	18.7835	
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	20.2556	19.7249	19.9807	20.3426	20.6772	20.9013	20.9744	20.9645	20.8283	20.4177	19.9189	19.7078	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house	0.9824	0.9721	0.9557	0.9099	0.8108	0.6250	0.4412	0.4836	0.7247	0.9126	0.9691	0.9848	(89)
MIT 2	19.4824	19.0081	19.2602	19.6110	19.9215	20.1072	20.1551	20.1502	20.0542	19.6872	19.2015	18.9768	(90)
Living area fraction									fLA = Living area / (4) =			0.1517	(91)
MIT	19.5996	19.1168	19.3695	19.7220	20.0361	20.2276	20.2794	20.2737	20.1716	19.7980	19.3103	19.0877	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5996	19.1168	19.3695	19.7220	20.0361	20.2276	20.2794	20.2737	20.1716	19.7980	19.3103	19.0877	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9648	0.9466	0.8995	0.8046	0.6304	0.4542	0.4961	0.7252	0.9027	0.9615	0.9806	(94)
Useful gains	734.7923	796.3576	806.8578	803.4807	732.1423	565.0044	389.9801	407.0330	575.7341	677.1528	700.8019	709.9831	(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	1657.7956	1540.4620	1394.4739	1172.6203	903.2641	609.7796	398.6819	419.7324	657.8882	996.6499	1323.0448	1613.1549	(97)
Space heating kWh	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98a)
Space heating requirement - total per year (kWh/year)												3374.7145	
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	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3374.7145	
Space heating per m2											(98c) / (4) =	28.1062	(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 %)	298.5716	(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	686.7144	500.0382	437.1863	265.7805	127.3146	0.0000	0.0000	0.0000	0.0000	237.7058	448.0149	671.9598	(98)
Space heating efficiency (main heating system 1)	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)	229.9999	167.4768	146.4260	89.0174	42.6412	0.0000	0.0000	0.0000	0.0000	79.6144	150.0528	225.0582	(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												
	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808 (64)
Efficiency of water heater												305.9950 (216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950 (217)
Fuel for water heating, kWh/month												
	91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932 (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	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475 (231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1130.2867 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	305.9950
Water heating fuel used	910.5279 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)	
mechanical ventilation fans (SFP = 0.1066)	39.4141 (230a)
Total electricity for the above, kWh/year	39.4141 (231)
Electricity for lighting (calculated in Appendix L)	272.9407 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2353.1694 (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	1130.2867	0.1550	175.2176	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			303.6264	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Total CO2, kg/year			348.4874	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9000	(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	1130.2867	1.5739	1778.9661	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	1.5215	1385.3429	(278)
Space and water heating			3164.3090	(279)
Pumps, fans and electric keep-hot	39.4141	1.5128	59.6257	(281)
Energy for lighting	272.9407	1.5338	418.6456	(282)
Total Primary energy kWh/year			3642.5803	(286)
Dwelling Primary energy Rate (DPER)			30.3400	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000	(1b) x	2.3900	(2b) =	101.8140	(1b) - (3b)
First floor	42.6000	(1c) x	2.6700	(2c) =	113.7420	(1c) - (3c)
Second floor	34.8700	(1d) x	2.5100	(2d) =	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 303.0797 (5)

---

2. Ventilation rate

---

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1320	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3820	(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) =	0.3247	(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	0.4140	0.4059	0.3977	0.3571	0.3490	0.3084	0.3084	0.3003	0.3247	0.3490	0.3653	0.3815	(22b)
Effective ac	0.5857	0.5824	0.5791	0.5638	0.5609	0.5476	0.5476	0.5451	0.5527	0.5609	0.5667	0.5728	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.1300	1.0000	2.1300			(26)
TER Opening Type			12.4500	1.1450	14.2557			(27)
TER Roof Window			0.4500	1.1450	0.6368			(27a)
Jetfloor 150/150 Grey			42.6000	0.1300	5.5380			(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634			(29a)
Smartroof Spandrel	19.9100		19.9100	0.1800	3.5838			(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.1800	0.5310			(29a)
Wall to Voids	11.9900		11.9900	0.1800	2.1582			(29a)
500mm Mineral Wool	23.9100		23.9100	0.1100	2.6301			(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1100	1.3816			(30)
Ceiling to Voids	7.7300		7.7300	0.1100	0.8503			(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.1100	0.1595			(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.6184			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000			(32)
Smartroof Spandrel			19.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.7754 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0500	0.4105
E2 Other lintels (including other steel lintels)	1.0130	0.0500	0.0507
E3 Sill	6.4100	0.0500	0.3205
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	19.8000	0.0500	0.9900
E5 Ground floor (normal)	8.8000	0.1600	1.4080
E5 Ground floor (normal)	9.6800	0.1600	1.5488
E6 Intermediate floor within a dwelling	28.1600	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.6800	0.0400	0.3872
E12 Gable (insulation at ceiling level)	4.9400	0.0600	0.2964
E16 Corner (normal)	11.5000	0.0900	1.0350
P1 Party wall - Ground floor	8.8000	0.0800	0.7040
E18 Party wall between dwellings	11.5000	0.0600	0.6900
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.1200	0.5928
E6 Intermediate floor within a dwelling	8.8000	0.0000	0.0000
E13 Gable (insulation at rafter level)	5.4300	0.0800	0.4344
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0800	0.4344
R1 Head of roof window	0.5800	0.0800	0.0464
R2 Sill of roof window	0.5800	0.0600	0.0348
R3 Jamb of roof window	1.5600	0.0800	0.1248
R1 Head of roof window	1.2000	0.0800	0.0960
R2 Sill of roof window	1.2000	0.0600	0.0720
R3 Jamb of roof window	2.4200	0.0800	0.1936
E16 Corner (normal)	3.0400	0.0900	0.2736
R6 Flat ceiling	9.6800	0.0600	0.5808
R7 Flat ceiling (inverted)	2.1400	0.0400	0.0856
R7 Flat ceiling (inverted)	3.5200	0.0400	0.1408
R9 Roof to wall (flat ceiling)	2.5000	0.0400	0.1000
R9 Roof to wall (flat ceiling)	2.1400	0.0400	0.0856
R4 Ridge (vaulted ceiling)	1.2500	0.0800	0.1000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4466 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 62.0651 (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	58.5781	58.2453	57.9191	56.3870	56.1003	54.7659	54.7659	54.5188	55.2799	56.1003	56.6802	57.2865	(38)
Heat transfer coeff	120.6431	120.3104	119.9842	118.4521	118.1654	116.8310	116.8310	116.5839	117.3450	118.1654	118.7453	119.3516	(39)

Average = Sum(39)m / 12 = 118.4507

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0048	1.0020	0.9993	0.9865	0.9841	0.9730	0.9730	0.9710	0.9773	0.9841	0.9890	0.9940	(40)

HLP (average)												0.9865	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8636	(42)
Hot water usage for mixer showers													
	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths													
	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses													
	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m													
	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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													
	285.1515	252.1166	267.5282	234.2934	226.5295	203.4688	200.2532	208.5140	211.1604	236.2617	252.2271	281.9008	(62)
WWHRS	-33.0218	-29.2047	-30.5815	-25.3227	-23.5999	-20.1946	-18.9292	-20.1293	-20.8941	-24.6318	-27.9048	-32.4103	(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													
	252.1297	222.9118	236.9467	208.9707	202.9296	183.2743	181.3241	188.3847	190.2663	211.6299	224.3222	249.4905	(64)
										Total per year (kWh/year) = Sum(64)m =		2552.5806	(64)
12Total per year (kWh/year)												2553	(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													
	119.0044	105.6792	113.1447	101.3137	99.5126	91.0645	90.7757	93.5224	93.6220	102.7485	107.2767	117.9235	(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	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	143.1792	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	163.3936	180.9001	163.3936	168.8401	163.3936	168.8401	163.3936	163.3936	168.8401	163.3936	168.8401	163.3936	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.3043	288.2648	280.8043	264.9217	244.8728	226.0297	213.4413	210.4807	217.9412	233.8238	253.8727	272.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	37.3179	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	159.9522	157.2607	152.0762	140.7135	133.7535	126.4785	122.0104	125.7022	130.0306	138.1029	148.9954	158.4994	(72)
Total internal gains													
	677.6038	695.3794	665.2279	643.4290	610.9737	587.3020	564.7991	565.5303	582.7656	604.2741	640.6619	663.5627	(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	6.8900	10.6334	0.6300	0.7000	0.7700	22.3905	(74)
South	5.0900	46.7521	0.6300	0.7000	0.7700	72.7261	(78)
West	0.4700	19.6403	0.6300	0.7000	0.7700	2.8211	(80)
North	0.4500	15.2954	0.6300	0.7000	1.0000	2.7318	(82)

Solar gains	100.6695	172.5010	242.4914	317.4239	375.4591	382.6889	364.7271	319.1268	267.6659	192.0322	120.6744	86.1395	(83)
Total gains	778.2733	867.8804	907.7192	960.8529	986.4328	969.9909	929.5261	884.6571	850.4315	796.3063	761.3363	749.7021	(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	43.0654	43.1845	43.3019	43.8620	43.9684	44.4706	44.4706	44.5648	44.2758	43.9684	43.7537	43.5314	
alpha	3.8710	3.8790	3.8868	3.9241	3.9312	3.9647	3.9647	3.9710	3.9517	3.9312	3.9169	3.9021	
util living area													
	0.9844	0.9750	0.9602	0.9202	0.8378	0.6841	0.5281	0.5705	0.7780	0.9275	0.9734	0.9864	(86)
MIT	19.3500	19.5574	19.8510	20.2708	20.6379	20.8878	20.9691	20.9579	20.8029	20.3484	19.7930	19.3227	(87)
Th 2	20.0794	20.0817	20.0839	20.0946	20.0966	20.1059	20.1059	20.1076	20.1023	20.0966	20.0925	20.0883	(88)
util rest of house													
	0.9812	0.9699	0.9517	0.9022	0.7995	0.6128	0.4309	0.4736	0.7169	0.9076	0.9671	0.9837	(89)
MIT 2	18.1462	18.4106	18.7831	19.3121	19.7495	20.0223	20.0904	20.0849	19.9405	19.4154	18.7191	18.1175	(90)
Living area fraction											fLA = Living area / (4) =	0.1517	(91)

MIT	18.3288	18.5845	18.9451	19.4575	19.8843	20.1535	20.2237	20.2173	20.0713	19.5569	18.8820	18.3003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3288	18.5845	18.9451	19.4575	19.8843	20.1535	20.2237	20.2173	20.0713	19.5569	18.8820	18.3003	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9727	0.9587	0.9379	0.8867	0.7892	0.6169	0.4443	0.4862	0.7145	0.8927	0.9557	0.9759	(94)
Useful gains	757.0121	832.0633	851.3468	851.9661	778.5374	598.3491	412.9477	430.0996	607.6443	710.8699	727.6339	731.6371	(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	1692.4780	1646.3907	1493.2109	1250.5600	967.0990	648.8257	423.3569	445.0401	700.7047	1058.3993	1399.0542	1682.8937	(97)
Space heating kWh	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(98a)
Space heating requirement - total per year (kWh/year)												3597.7585	
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	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3597.7585	
Space heating per m2											(98c) / (4) =	29.9638	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	695.9866	547.2280	477.5469	286.9877	140.2898	0.0000	0.0000	0.0000	0.0000	258.5619	483.4226	707.7349	(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)	754.0483	592.8797	517.3856	310.9292	151.9933	0.0000	0.0000	0.0000	0.0000	280.1321	523.7515	766.7768	(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	252.1297	222.9118	236.9467	208.9707	202.9296	183.2743	181.3241	188.3847	190.2663	211.6299	224.3222	249.4905	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2143	85.9929	85.5985	84.7716	83.2487	79.8000	79.8000	79.8000	79.8000	84.5101	85.7353	86.2642	(217)
Fuel for water heating, kWh/month	292.4455	259.2214	276.8119	246.5102	243.7630	229.6670	227.2231	236.0711	238.4290	250.4197	261.6452	289.2167	(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	33.9500	27.2359	24.5229	17.9665	13.8779	11.3383	12.6599	16.4558	21.3744	28.0444	31.6761	34.8935	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.4013	-59.1679	-86.1606	-98.1306	-106.8130	-99.9885	-98.7196	-92.7131	-82.2700	-68.2131	-45.7879	-35.6978	(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	-20.9735	-44.3946	-88.7716	-134.1258	-178.1531	-179.3538	-177.2810	-149.7567	-109.2845	-63.7905	-28.0957	-16.5673	(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	3897.8965	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3051.4236	(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)	273.9957	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2105.6117	(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	5203.7042	(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	3897.8965	0.2100	818.5583	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3051.4236	0.2100	640.7990	(264)
Space and water heating			1459.3572	(265)

Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	273.9957	0.1443	39.5460	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-915.0636	0.1343	-122.9169	
PV Unit electricity exported	-1190.5481	0.1257	-149.6688	
Total			-272.5857	(269)
Total CO2, kg/year			1238.2468	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3100	(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	3897.8965	1.1300	4404.6231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3051.4236	1.1300	3448.1087	(278)
Space and water heating			7852.7318	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	273.9957	1.5338	420.2637	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-915.0636	1.4964	-1369.3304	
PV Unit electricity exported	-1190.5481	0.4614	-549.3766	
Total			-1918.7070	(283)
Total Primary energy kWh/year			6484.3893	(286)
Target Primary Energy Rate (TPER)			54.0100	(287)

Full SAP Calculation Printout

Property Reference	4907-P635-7667-Oakrise_End	**Issued on Date**	22/04/2025
Assessment Reference	Plot XX	**Prop Type Ref**	Oakrise End (AS)
Property	Plot XX, Oakrise End (AS)		

SAP Rating	87 B	**DER**	2.90	**TER**	10.31
Environmental	97 A	**% DER < TER**			71.87
CO_2 Emissions (t/year)	0.33	**DFEE**	34.14	**TFEE**	35.25
Compliance Check	See BREL	**% DFEE < TFEE**			3.15
% DPER < TPER	43.83	**DPER**	30.34	**TPER**	54.01

Assessor Details	Mr. Mitchell Bennellick	**Assessor ID**	P635-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(22b)

Mechanical extract ventilation - decentralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.3888		(33)
Main dwelling						
E-WM-28	44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel	19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber	72.8900			9.0000	656.0100	(32c)
1F - Timber	105.3000			9.0000	947.7000	(32c)
2F - Timber	22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F	42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F	34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF	42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F	34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18703.9500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.7754	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
E3 Sill	6.4100	0.0380	0.2436
E4 Jamb	4.2000	0.0410	0.1722
E4 Jamb	19.8000	0.0410	0.8118
E5 Ground floor (normal)	8.8000	0.0520	0.4576
E5 Ground floor (normal)	9.6800	0.0450	0.4356
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
E16 Corner (normal)	11.5000	0.0410	0.4715
P1 Party wall - Ground floor	8.8000	0.0580	0.5104
E18 Party wall between dwellings	11.5000	0.0380	0.4370
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172
R1 Head of roof window	0.5800	0.1150	0.0667
R2 Sill of roof window	0.5800	0.1130	0.0655
R3 Jamb of roof window	1.5600	0.0410	0.0640
R1 Head of roof window	1.2000	0.0130	0.0156
R2 Sill of roof window	1.2000	0.0230	0.0276
R3 Jamb of roof window	2.4200	0.0320	0.0774
E16 Corner (normal)	3.0400	0.0610	0.1854
R6 Flat ceiling	9.6800	0.0190	0.1839
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.9583	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	58.3471	(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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)
Average = Sum(39)m / 12 =												108.3552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8636	(42)
Hot water usage for mixer showers	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
										Total per year (kWh/year) = Sum(64)m =		2786.1698	(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	114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.6376	34.3176	27.9089	21.1288	15.7941	13.3340	14.4079	18.7279	25.1365	31.9166	37.2514	39.7114	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	425.8273	430.2460	419.1109	395.4056	365.4818	337.3577	318.5691	314.1503	325.2854	348.9908	378.9145	407.0386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	(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)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains													
	730.0456	727.4529	704.7246	662.8765	620.6580	582.7989	560.6160	564.2090	586.0811	624.6389	670.7899	710.8781	(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	3.1100	10.6334	0.3100	0.0000	0.7700	7.8938	(74)
South	5.0900	46.7521	0.3100	0.0000	0.7700	56.8030	(78)
West	0.4700	19.6403	0.3100	0.0000	0.7700	2.2034	(80)
North	3.7800	10.6334	0.3500	0.0000	0.7700	10.8323	(74)
North	0.4500	15.2954	0.6400	0.7000	1.0000	2.7752	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	80.5077	138.2927	195.5258	258.1163	307.3995	314.2408	299.1144	260.2864	216.5213	154.2315	96.5623	68.8544	(83)
Total gains	810.5533	865.7456	900.2504	920.9928	928.0575	897.0397	859.7303	824.4954	802.6024	778.8704	767.3522	779.7325	(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, ni1,m (see Table 9a)													
tau	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area													
	0.9807	0.9727	0.9563	0.9196	0.8393	0.6923	0.5327	0.5733	0.7779	0.9232	0.9702	0.9835	(86)
Living	19.6212	19.7736	20.0348	20.3692	20.6891	20.9015	20.9745	20.9650	20.8324	20.4457	19.9649	19.5683	
Non living	18.9054	19.0557	19.3123	19.6356	19.9314	20.1073	20.1552	20.1504	20.0572	19.7128	19.2462	18.8533	
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	20.2946	19.7736	20.0348	20.3692	20.6891	20.9015	20.9745	20.9650	20.8324	20.4457	19.9649	19.7686	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house													
	0.9770	0.9674	0.9475	0.9021	0.8028	0.6246	0.4406	0.4815	0.7196	0.9031	0.9634	0.9803	(89)
MIT 2	19.5209	19.0557	19.3123	19.6356	19.9314	20.1073	20.1552	20.1504	20.0572	19.7128	19.2462	19.0368	(90)
Living area fraction										fLA = Living area / (4) =		0.1517	(91)
MIT	19.6382	19.1646	19.4219	19.7469	20.0463	20.2278	20.2795	20.2740	20.1747	19.8240	19.3552	19.1478	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6382	19.1646	19.4219	19.7469	20.0463	20.2278	20.2795	20.2740	20.1747	19.8240	19.3552	19.1478	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9594	0.9378	0.8917	0.7970	0.6300	0.4537	0.4940	0.7203	0.8933	0.9551	0.9753	(94)
Useful gains	789.6531	830.5679	844.2453	821.2850	739.6469	565.1373	390.0273	407.2669	578.1350	695.7628	732.9332	760.4901	(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													
	1661.9748	1545.6426	1400.1552	1175.3152	904.3661	609.7980	398.6883	419.7642	658.2306	999.4672	1327.9150	1619.6706	(97)
Space heating kWh													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	0.0000	225.9561	428.3869	639.2303	(98a)
Space heating requirement - total per year (kWh/year)												3214.1606	
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													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	0.0000	225.9561	428.3869	639.2303	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3214.1606	
Space heating per m2											(98c) / (4) =	26.7691	(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 %)	298.5716	(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													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	0.0000	225.9561	428.3869	639.2303	(98)
Space heating efficiency (main heating system 1)													
	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)													
	217.3708	160.9431	138.5253	85.3737	41.0458	0.0000	0.0000	0.0000	0.0000	75.6790	143.4788	214.0962	(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

278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)

Efficiency of water heater											305.9950	(216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	(217)

Fuel for water heating, kWh/month

91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932	(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	(221)
Pumps and Fa	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475	(231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1076.5127	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	305.9950	
Water heating fuel used	910.5279	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)		
mechanical ventilation fans (SFP = 0.1066)	39.4141	(230a)
Total electricity for the above, kWh/year	39.4141	(231)
Electricity for lighting (calculated in Appendix L)	272.9407	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2299.3954	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1076.5127	16.4900	177.5169	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	16.4900	150.1460	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	39.4141	16.4900	6.4994	(249)
Energy for lighting	272.9407	16.4900	45.0079	(250)
Additional standing charges			0.0000	(251)
Total energy cost			379.1703	(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] =	0.8269	(257)
SAP value		86.5955	
SAP rating (Section 12)		87	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1076.5127	0.1550	166.8585	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			295.2673	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Total CO2, kg/year			340.1283	(272)
CO2 emissions per m2			2.8300	(273)
EI value			97.2389	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000	(22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500	(22a)
Adj infilt rate	0.2343	0.2199	0.2247	0.2056	0.2056	0.1817	0.1817	0.1769	0.1817	0.2056	0.2056	0.2199	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.3888			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel			19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber			72.8900			9.0000	656.0100	(32c)
1F - Timber			105.3000			9.0000	947.7000	(32c)
2F - Timber			22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F			42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F			34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF			42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F			34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 18703.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.7754 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
E3 Sill	6.4100	0.0380	0.2436
E4 Jamb	4.2000	0.0410	0.1722
E4 Jamb	19.8000	0.0410	0.8118
E5 Ground floor (normal)	8.8000	0.0520	0.4576
E5 Ground floor (normal)	9.6800	0.0450	0.4356
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
E16 Corner (normal)	11.5000	0.0410	0.4715
P1 Party wall - Ground floor	8.8000	0.0580	0.5104
E18 Party wall between dwellings	11.5000	0.0380	0.4370
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149

P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172	
R1 Head of roof window	0.5800	0.1150	0.0667	
R2 Sill of roof window	0.5800	0.1130	0.0655	
R3 Jamb of roof window	1.5600	0.0410	0.0640	
R1 Head of roof window	1.2000	0.0130	0.0156	
R2 Sill of roof window	1.2000	0.0230	0.0276	
R3 Jamb of roof window	2.4200	0.0320	0.0774	
E16 Corner (normal)	3.0400	0.0610	0.1854	
R6 Flat ceiling	9.6800	0.0190	0.1839	
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835	
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176	
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675	
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621	
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9583 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.3471 (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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)
Average = Sum(39)m / 12 =												108.3552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8636 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)
Hot water usage for baths	31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)
Hot water usage for other uses	43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)
Average daily hot water use (litres/day)												135.4701	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
										Total per year (kWh/year) = Sum(64)m =		2786.1698	(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	114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.6376	34.3176	27.9089	21.1288	15.7941	13.3340	14.4079	18.7279	25.1365	31.9166	37.2514	39.7114	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.8273	430.2460	419.1109	395.4056	365.4818	337.3577	318.5691	314.1503	325.2854	348.9908	378.9145	407.0386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	(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)	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains	730.0456	727.4529	704.7246	662.8765	620.6580	582.7989	560.6160	564.2090	586.0811	624.6389	670.7899	710.8781	(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	3.1100	12.7650	0.3100	0.0000	0.7700	9.4762	(74)
South	5.0900	54.2217	0.3100	0.0000	0.7700	65.8785	(78)

West			0.4700	23.8018	0.3100	0.0000	0.7700	2.6703	(80)				
North			3.7800	12.7650	0.3500	0.0000	0.7700	13.0039	(74)				
North			0.4500	18.1686	0.6400	0.7000	1.0000	3.2965	(82)				
Solar gains	94.3254	144.3844	206.4858	281.5954	318.6576	352.9774	323.5589	285.6783	237.7032	165.7751	11.1509	77.9888	(83)
Total gains	824.3710	871.8373	911.2105	944.4719	939.3156	935.7763	884.1749	849.8874	823.7844	790.4140	681.9408	788.8668	(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	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area	0.9768	0.9696	0.9494	0.9054	0.8136	0.6406	0.5094	0.5274	0.7466	0.9082	0.9761	0.9801	(86)
Living	19.7236	19.8369	20.1141	20.4392	20.7427	20.9311	20.9789	20.9760	20.8640	20.5177	19.9609	19.6799	
Non living	19.0068	19.1181	19.3896	19.7013	19.9779	20.1274	20.1573	20.1561	20.0812	19.7801	19.2438	18.9640	
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	20.3470	19.8369	20.1141	20.4392	20.7427	20.9311	20.9789	20.9760	20.8640	20.5177	19.9609	19.8646	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house	0.9723	0.9636	0.9390	0.8850	0.7719	0.5682	0.4179	0.4337	0.6831	0.8841	0.9703	0.9761	(89)
MIT 2	19.5727	19.1181	19.3896	19.7013	19.9779	20.1274	20.1573	20.1561	20.0812	19.7801	19.2438	19.1320	(90)
Living area fraction										fLA = Living area / (4) =		0.1517	(91)
MIT	19.6902	19.2272	19.4995	19.8132	20.0939	20.2493	20.2819	20.2804	20.1999	19.8920	19.3525	19.2431	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6902	19.2272	19.4995	19.8132	20.0939	20.2493	20.2819	20.2804	20.1999	19.8920	19.3525	19.2431	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9692	0.9552	0.9289	0.8749	0.7680	0.5759	0.4311	0.4471	0.6859	0.8747	0.9628	0.9705	(94)
Useful gains	798.9736	832.7604	846.4426	826.3648	721.3883	538.9378	381.1420	379.9728	565.0595	691.3932	656.5962	765.6142	(95)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	1602.5903	1509.0799	1354.3808	1139.1641	855.3449	568.7925	388.1147	387.9557	628.4469	952.6592	1251.7769	1554.1545	(97)
Space heating kWh	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98a)
Space heating requirement - total per year (kWh/year)												2964.7487	
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	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2964.7487	
Space heating per m2										(98c) / (4) =		24.6918	(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 %) 298.5716 (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	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98)
Space heating efficiency (main heating system 1)	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)	200.2504	152.2204	126.5713	75.4310	33.3802	0.0000	0.0000	0.0000	0.0000	65.1040	143.5268	196.4936	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
Efficiency of water heater												305.9950	(216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	(217)
Fuel for water heating, kWh/month	91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932	(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	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475	(231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	992.9776	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	305.9950	
Water heating fuel used	910.5279	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)		
mechanical ventilation fans (SFP = 0.1066)	39.4141	(230a)
Total electricity for the above, kWh/year	39.4141	(231)
Electricity for lighting (calculated in Appendix L)	272.9407	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2215.8604	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	992.9776	26.0600	258.7700	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	26.0600	237.2836	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	39.4141	26.0600	10.2713	(249)
Energy for lighting	272.9407	26.0600	71.1284	(250)
Additional standing charges			0.0000	(251)
Total energy cost			577.4532	(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	992.9776	0.1552	154.1094	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			282.5183	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Total CO2, kg/year			327.3793	(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	992.9776	1.5746	1563.5046	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	1.5215	1385.3429	(278)
Space and water heating			2948.8475	(279)
Pumps, fans and electric keep-hot	39.4141	1.5128	59.6257	(281)
Energy for lighting	272.9407	1.5338	418.6456	(282)
Total Primary energy kWh/year			3427.1188	(286)

SAP 10 EPC IMPROVEMENTS

Plot XX

Current energy efficiency rating: B 87
Current environmental impact rating: A 97

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 5.3	-£ 238	-122 kg (37.3%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.8	-£ 44	-20 kg (6.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£238	1.02 kg/m²	A 92	A 98
Total Savings	£238	1.02 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£577	£577	£0
Space heating	£269	£269	£0

Water heating	£237	£237	£0
Lighting	£71	£71	£0
Generated (PV)	-£0	-£238	£238
Total cost of fuels	£577	£339	£238
Total cost of uses	£577	£339	£238
Delivered energy	18 kWh/m²	11 kWh/m²	8 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.1 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	29 kWh/m²	17 kWh/m²	11 kWh/m²

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 (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000	(1b) x	2.3900	(2b) =	101.8140	(1b) - (3b)
First floor	42.6000	(1c) x	2.6700	(2c) =	113.7420	(1c) - (3c)
Second floor	34.8700	(1d) x	2.5100	(2d) =	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.3888			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel			19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber			72.8900			9.0000	656.0100	(32c)
1F - Timber			105.3000			9.0000	947.7000	(32c)
2F - Timber			22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F			42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F			34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF			42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F			34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18703.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.7754 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
	E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
	E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
	E3 Sill	6.4100	0.0380	0.2436
	E4 Jamb	4.2000	0.0410	0.1722
	E4 Jamb	19.8000	0.0410	0.8118
	E5 Ground floor (normal)	8.8000	0.0520	0.4576
	E5 Ground floor (normal)	9.6800	0.0450	0.4356
	E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
	E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
	E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
	E16 Corner (normal)	11.5000	0.0410	0.4715
	P1 Party wall - Ground floor	8.8000	0.0580	0.5104
	E18 Party wall between dwellings	11.5000	0.0380	0.4370
	P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
	P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
	E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
	E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149
	P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172
	R1 Head of roof window	0.5800	0.1150	0.0667
	R2 Sill of roof window	0.5800	0.1130	0.0655
	R3 Jamb of roof window	1.5600	0.0410	0.0640
	R1 Head of roof window	1.2000	0.0130	0.0156
	R2 Sill of roof window	1.2000	0.0230	0.0276
	R3 Jamb of roof window	2.4200	0.0320	0.0774
	E16 Corner (normal)	3.0400	0.0610	0.1854
	R6 Flat ceiling	9.6800	0.0190	0.1839
	R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835
	R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176
	R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675
	R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621
	R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9583 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.3471 (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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)
Average = Sum(39)m / 12 =												108.3552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8636 (42)
Hot water usage for mixer showers

72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)

Hot water usage for baths

31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)

Hot water usage for other uses

43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)

Average daily hot water use (litres/day) 135.4701 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)
Energy content (annual)										Total = Sum(45)m =		2250.1308	
Distribution loss (46)m = 0.15 x (45)m	35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
										Total per year (kWh/year) = Sum(64)m =		2786.1698	(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	114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.6376	34.3176	27.9089	21.1288	15.7941	13.3340	14.4079	18.7279	25.1365	31.9166	37.2514	39.7114	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.8273	430.2460	419.1109	395.4056	365.4818	337.3577	318.5691	314.1503	325.2854	348.9908	378.9145	407.0386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	(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)													
	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)													
	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains													
	730.0456	727.4529	704.7246	662.8765	620.6580	582.7989	560.6160	564.2090	586.0811	624.6389	670.7899	710.8781	(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	3.1100	10.6334	0.3100	0.0000	0.7700	7.8938	(74)
South	5.0900	46.7521	0.3100	0.0000	0.7700	56.8030	(78)
West	0.4700	19.6403	0.3100	0.0000	0.7700	2.2034	(80)
North	3.7800	10.6334	0.3500	0.0000	0.7700	10.8323	(74)
North	0.4500	15.2954	0.6400	0.7000	1.0000	2.7752	(82)

Solar gains	80.5077	138.2927	195.5258	258.1163	307.3995	314.2408	299.1144	260.2864	216.5213	154.2315	96.5623	68.8544	(83)
Total gains	810.5533	865.7456	900.2504	920.9928	928.0575	897.0397	859.7303	824.4954	802.6024	778.8704	767.3522	779.7325	(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	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area													
	0.9807	0.9727	0.9563	0.9196	0.8393	0.6923	0.5327	0.5733	0.7779	0.9232	0.9702	0.9835	(86)
Living	19.6212	19.7736	20.0348	20.3692	20.6891	20.9015	20.9745	20.9650	20.8324	20.4457	19.9649	19.5683	
Non living	18.9054	19.0557	19.3123	19.6356	19.9314	20.1073	20.1552	20.1504	20.0572	19.7128	19.2462	18.8533	
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	20.2946	19.7736	20.0348	20.3692	20.6891	20.9015	20.9745	20.9650	20.8324	20.4457	19.9649	19.7686	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house													
	0.9770	0.9674	0.9475	0.9021	0.8028	0.6246	0.4406	0.4815	0.7196	0.9031	0.9634	0.9803	(89)
MIT 2	19.5209	19.0557	19.3123	19.6356	19.9314	20.1073	20.1552	20.1504	20.0572	19.7128	19.2462	19.0368	(90)
Living area fraction										fLA = Living area / (4) =		0.1517	(91)
MIT	19.6382	19.1646	19.4219	19.7469	20.0463	20.2278	20.2795	20.2740	20.1747	19.8240	19.3552	19.1478	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6382	19.1646	19.4219	19.7469	20.0463	20.2278	20.2795	20.2740	20.1747	19.8240	19.3552	19.1478	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9594	0.9378	0.8917	0.7970	0.6300	0.4537	0.4940	0.7203	0.8933	0.9551	0.9753	(94)
Useful gains	789.6531	830.5679	844.2453	821.2850	739.6469	565.1373	390.0273	407.2669	578.1350	695.7628	732.9332	760.4901	(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													
	1661.9748	1545.6426	1400.1552	1175.3152	904.3661	609.7980	398.6883	419.7642	658.2306	999.4672	1327.9150	1619.6706	(97)
Space heating kWh													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	0.0000	225.9561	428.3869	639.2303	(98a)
Space heating requirement - total per year (kWh/year)												3214.1606	
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													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	225.9561	428.3869		639.2303	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3214.1606	
Space heating per m2											(98c) / (4) =	26.7691	(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 %)	298.5716	(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													
	649.0074	480.5302	413.5970	254.9017	122.5511	0.0000	0.0000	0.0000	0.0000	225.9561	428.3869	639.2303	(98)
Space heating efficiency (main heating system 1)													
	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)													
	217.3708	160.9431	138.5253	85.3737	41.0458	0.0000	0.0000	0.0000	0.0000	75.6790	143.4788	214.0962	(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													
	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
Efficiency of water heater												305.9950	(216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	(217)
Fuel for water heating, kWh/month													
	91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932	(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	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475	(231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.2091	-57.0118	-86.3230	-100.7443	-109.7841	-99.5794	-98.2021	-91.1198	-78.7087	-65.6539	-42.7287	-32.6290	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1076.5127	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	305.9950	
Water heating fuel used	910.5279	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)		
mechanical ventilation fans (SFP = 0.1066)	39.4141	(230a)
Total electricity for the above, kWh/year	39.4141	(231)
Electricity for lighting (calculated in Appendix L)	272.9407	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-900.6939	(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	1398.7015	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1076.5127	16.4900	177.5169	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	16.4900	150.1460	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	39.4141	16.4900	6.4994	(249)
Energy for lighting	272.9407	16.4900	45.0079	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6939	16.4900	-148.5244	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-148.5244	(252)
Total energy cost			230.6459	(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] =	0.5030	(257)
SAP value	91.8461	
SAP rating (Section 12)	92	(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	1076.5127	0.1550	166.8585	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			295.2673	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6939	0.1341	-120.8127	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-120.8127	(269)
Total CO2, kg/year			219.3157	(272)
CO2 emissions per m2			1.8300	(273)
EI value			98.2196	
EI rating			98	(274)
EI band			A	

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.6000 (1b)	x	2.3900 (2b)	=	101.8140	(1b) - (3b)
First floor	42.6000 (1c)	x	2.6700 (2c)	=	113.7420	(1c) - (3c)
Second floor	34.8700 (1d)	x	2.5100 (2d)	=	87.5237	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	303.0797	(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		4.5000	(17)
Infiltration rate		0.2250	(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) =	0.1913	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000	(22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500	(22a)
Adj infilt rate	0.2343	0.2199	0.2247	0.2056	0.2056	0.1817	0.1817	0.1769	0.1817	0.2056	0.2056	0.2199	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			2.1300	1.1000	2.3430			(26)
Windows			8.6700	1.1450	9.9275			(27)
French Doors			3.7800	1.1450	4.3282			(27)
Rooflights (1.30u)			0.4500	1.5918	0.7163			(27a)
Jetfloor 150/150 Grey			42.6000	0.1100	4.6860	75.0000	3195.0000	(28a)
External Wall - 150mm FF AAC	106.2600	13.1300	93.1300	0.1800	16.7634	60.0000	5587.8001	(29a)
Smartroof Spandrel	19.9100		19.9100	0.2000	3.9820	9.0000	179.1900	(29a)
Dormer Cheek (IG APEX)	4.4000	1.4500	2.9500	0.2500	0.7375	9.0000	26.5500	(29a)
Wall to Voids	11.9900		11.9900	0.1200	1.4388	9.0000	107.9100	(29a)
500mm Mineral Wool	23.9100		23.9100	0.0900	2.1519	9.0000	215.1900	(30)
Smartroof Cassette	13.0100	0.4500	12.5600	0.1600	2.0096	9.0000	113.0400	(30)
Ceiling to Voids	7.7300		7.7300	0.1200	0.9276	9.0000	69.5700	(30)
Dormer Roof (IG Apex)	1.4500		1.4500	0.2600	0.3770	9.0000	13.0500	(30)
Total net area of external elements Aum(A, m2)			231.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.3888			(33)
Main dwelling								
E-WM-28			44.5300	0.0000	0.0000	110.0000	4898.2999	(32)
Smartroof Spandrel			19.9100	0.0000	0.0000	20.0000	398.2000	(32)
GF - Timber			72.8900			9.0000	656.0100	(32c)
1F - Timber			105.3000			9.0000	947.7000	(32c)
2F - Timber			22.7500			9.0000	204.7500	(32c)
Internal Floor - 1F			42.6000			18.0000	766.8000	(32d)
Internal Floor - 2F			34.8700			18.0000	627.6600	(32d)
Internal Ceiling - GF			42.6000			9.0000	383.4000	(32e)
Internal Ceiling - 1F			34.8700			9.0000	313.8300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18703.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.7754 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.2100	0.0670	0.5501
E2 Other lintels (including other steel lintels)	1.0130	0.0670	0.0679
E3 Sill	6.4100	0.0380	0.2436
E4 Jamb	4.2000	0.0410	0.1722
E4 Jamb	19.8000	0.0410	0.8118
E5 Ground floor (normal)	8.8000	0.0520	0.4576
E5 Ground floor (normal)	9.6800	0.0450	0.4356
E6 Intermediate floor within a dwelling	28.1600	0.0010	0.0282
E11 Eaves (insulation at rafter level)	9.6800	0.0630	0.6098
E12 Gable (insulation at ceiling level)	4.9400	0.0480	0.2371
E16 Corner (normal)	11.5000	0.0410	0.4715
P1 Party wall - Ground floor	8.8000	0.0580	0.5104
E18 Party wall between dwellings	11.5000	0.0380	0.4370
P2 Party wall - Intermediate floor within a dwelling	17.6000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.9400	0.0490	0.2421
E6 Intermediate floor within a dwelling	8.8000	0.1400	1.2320
E13 Gable (insulation at rafter level)	5.4300	0.0580	0.3149
P5 Party wall - Roof (insulation at rafter level)	5.4300	0.0400	0.2172
R1 Head of roof window	0.5800	0.1150	0.0667

R2 Sill of roof window	0.5800	0.1130	0.0655	
R3 Jamb of roof window	1.5600	0.0410	0.0640	
R1 Head of roof window	1.2000	0.0130	0.0156	
R2 Sill of roof window	1.2000	0.0230	0.0276	
R3 Jamb of roof window	2.4200	0.0320	0.0774	
E16 Corner (normal)	3.0400	0.0610	0.1854	
R6 Flat ceiling	9.6800	0.0190	0.1839	
R7 Flat ceiling (inverted)	2.1400	0.0390	0.0835	
R7 Flat ceiling (inverted)	3.5200	0.0050	0.0176	
R9 Roof to wall (flat ceiling)	2.5000	0.0270	0.0675	
R9 Roof to wall (flat ceiling)	2.1400	0.0290	0.0621	
R4 Ridge (vaulted ceiling)	1.2500	0.0020	0.0025	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9583 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.3471 (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	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	50.0082	(38)
Heat transfer coeff	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	108.3552	(39)

Average = Sum(39)m / 12 = 108.3552

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	0.9024	(40)
HLP (average)												0.9024	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8636 (42)

Hot water usage for mixer showers

72.2327	71.1472	69.5654	66.5389	64.3054	61.8146	60.3989	61.9687	63.6895	66.3639	69.4554	71.9560	(42a)

Hot water usage for baths

31.1857	30.7225	30.0703	28.8677	27.9673	26.9688	26.4295	27.0771	27.7823	28.8507	30.0780	31.0802	(42b)

Hot water usage for other uses

43.9560	42.3576	40.7592	39.1608	37.5624	35.9640	35.9640	37.5624	39.1608	40.7592	42.3576	43.9560	(42c)

Average daily hot water use (litres/day) 135.4701 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3743	144.2273	140.3949	134.5674	129.8350	124.7474	122.7923	126.6082	130.6326	135.9737	141.8910	146.9922	(44)
Energy conte	233.4049	205.3777	215.7817	184.2160	174.7829	153.3915	148.5067	156.7674	161.0831	184.5151	202.1497	230.1542	(45)

Energy content (annual) Total = Sum(45)m = 2250.1308

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

35.0107	30.8067	32.3672	27.6324	26.2174	23.0087	22.2760	23.5151	24.1625	27.6773	30.3225	34.5231	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(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

278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(62)
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)
-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

278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)

Total per year (kWh/year) = Sum(64)m = 2786.1698 (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

114.0284	101.1847	108.1687	96.4982	94.5366	86.2491	85.7997	88.5464	88.8065	97.7725	102.4612	112.9476	(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	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	171.8151	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.6376	34.3176	27.9089	21.1288	15.7941	13.3340	14.4079	18.7279	25.1365	31.9166	37.2514	39.7114	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	425.8273	430.2460	419.1109	395.4056	365.4818	337.3577	318.5691	314.1503	325.2854	348.9908	378.9145	407.0386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	55.0451	(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)	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	-114.5434	(71)
Water heating gains (Table 5)	153.2640	150.5725	145.3880	134.0253	127.0653	119.7904	115.3222	119.0140	123.3424	131.4147	142.3072	151.8112	(72)
Total internal gains	730.0456	727.4529	704.7246	662.8765	620.6580	582.7989	560.6160	564.2090	586.0811	624.6389	670.7899	710.8781	(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	3.1100	12.7650	0.3100	0.0000	0.7700	9.4762	(74)
South	5.0900	54.2217	0.3100	0.0000	0.7700	65.8785	(78)
West	0.4700	23.8018	0.3100	0.0000	0.7700	2.6703	(80)
North	3.7800	12.7650	0.3500	0.0000	0.7700	13.0039	(74)

North				0.4500	18.1686	0.6400	0.7000	1.0000				3.2965	(82)
Solar gains	94.3254	144.3844	206.4858	281.5954	318.6576	352.9774	323.5589	285.6783	237.7032	165.7751	11.1509	77.9888	(83)
Total gains	824.3710	871.8373	911.2105	944.4719	939.3156	935.7763	884.1749	849.8874	823.7844	790.4140	681.9408	788.8668	(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	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	47.9492	
alpha	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	4.1966	
util living area	0.9768	0.9696	0.9494	0.9054	0.8136	0.6406	0.5094	0.5274	0.7466	0.9082	0.9761	0.9801	(86)
Living	19.7236	19.8369	20.1141	20.4392	20.7427	20.9311	20.9789	20.9760	20.8640	20.5177	19.9609	19.6799	
Non living	19.0068	19.1181	19.3896	19.7013	19.9779	20.1274	20.1573	20.1561	20.0812	19.7801	19.2438	18.9640	
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	20.3470	19.8369	20.1141	20.4392	20.7427	20.9311	20.9789	20.9760	20.8640	20.5177	19.9609	19.8646	(87)
Th 2	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	20.1654	(88)
util rest of house	0.9723	0.9636	0.9390	0.8850	0.7719	0.5682	0.4179	0.4337	0.6831	0.8841	0.9703	0.9761	(89)
MIT 2	19.5727	19.1181	19.3896	19.7013	19.9779	20.1274	20.1573	20.1561	20.0812	19.7801	19.2438	19.1320	(90)
Living area fraction										fLA = Living area / (4) =		0.1517	(91)
MIT	19.6902	19.2272	19.4995	19.8132	20.0939	20.2493	20.2819	20.2804	20.1999	19.8920	19.3525	19.2431	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6902	19.2272	19.4995	19.8132	20.0939	20.2493	20.2819	20.2804	20.1999	19.8920	19.3525	19.2431	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9692	0.9552	0.9289	0.8749	0.7680	0.5759	0.4311	0.4471	0.6859	0.8747	0.9628	0.9705	(94)
Useful gains	798.9736	832.7604	846.4426	826.3648	721.3883	538.9378	381.1420	379.9728	565.0595	691.3932	656.5962	765.6142	(95)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	1602.5903	1509.0799	1354.3808	1139.1641	855.3449	568.7925	388.1147	387.9557	628.4469	952.6592	1251.7769	1554.1545	(97)
Space heating kWh	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98a)
Space heating requirement - total per year (kWh/year)												2964.7487	
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	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2964.7487	
Space heating per m2											(98c) / (4) =	24.6918	(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 %)												298.5716	(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	597.8908	454.4867	377.9060	225.2155	99.6637	0.0000	0.0000	0.0000	0.0000	194.3819	428.5301	586.6739	(98)
Space heating efficiency (main heating system 1)	298.5716	298.5716	298.5716	298.5716	298.5716	0.0000	0.0000	0.0000	0.0000	298.5716	298.5716	298.5716	(210)
Space heating fuel (main heating system)	200.2504	152.2204	126.5713	75.4310	33.3802	0.0000	0.0000	0.0000	0.0000	65.1040	143.5268	196.4936	(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	278.9315	246.4985	261.3083	228.2740	220.3095	197.4495	194.0333	202.2940	205.1411	230.0417	246.2077	275.6808	(64)
Efficiency of water heater												305.9950	(216)
(217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	(217)
Fuel for water heating, kWh/month	91.1556	80.5564	85.3963	74.6006	71.9977	64.5270	63.4106	66.1102	67.0407	75.1782	80.4614	90.0932	(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	3.3475	3.0235	3.3475	3.2395	3.3475	3.2395	3.3475	3.3475	3.2395	3.3475	3.2395	3.3475	(231)
Lighting	33.8193	27.1311	24.4285	17.8974	13.8244	11.2947	12.6111	16.3924	21.2921	27.9364	31.5541	34.7592	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.2908	-59.6566	-90.1629	-106.2272	-111.2235	-105.9838	-102.4195	-96.2856	-83.9995	-69.6731	-6.2588	-36.8160	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												992.9776	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	305.9950	
Water heating fuel used	910.5279	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.9440, total flow = 37.0000, SFP = 0.1066)		
mechanical ventilation fans (SFP = 0.1066)	39.4141	(230a)
Total electricity for the above, kWh/year	39.4141	(231)
Electricity for lighting (calculated in Appendix L)	272.9407	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-912.9973	(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	1302.8631	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	992.9776	26.0600	258.7700	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	26.0600	237.2836	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	39.4141	26.0600	10.2713	(249)
Energy for lighting	272.9407	26.0600	71.1284	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-912.9973	26.0600	-237.9271	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-237.9271	(252)
Total energy cost			339.5261	(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	992.9776	0.1552	154.1094	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	910.5279	0.1410	128.4088	(264)
Space and water heating			282.5183	(265)
Pumps, fans and electric keep-hot	39.4141	0.1387	5.4672	(267)
Energy for lighting	272.9407	0.1443	39.3938	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-912.9973	0.1336	-121.9715	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-121.9715	(269)
Total CO2, kg/year			205.4077	(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	992.9776	1.5746	1563.5046	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	910.5279	1.5215	1385.3429	(278)
Space and water heating			2948.8475	(279)
Pumps, fans and electric keep-hot	39.4141	1.5128	59.6257	(281)
Energy for lighting	272.9407	1.5338	418.6456	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-912.9973	1.4937	-1363.7726	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1363.7726	(283)
Total Primary energy kWh/year			2063.3462	(286)