Full SAP Calculation Printout

Property Reference	Plot 2	**Issued on Date**	21/12/2023
Assessment Reference	Plot 2 Baseline	**Prop Type Ref**	Plot 1 Be Green
Property	Plot 1 , 95, Avenue Road, London, NW8 6HY		

SAP Rating	70 C	**DER**	28.88	**TER**	12.08
Environmental	70 C	**% DER < TER**			-139.07
CO_2 Emissions (t/year)	4.02	**DFEE**	104.57	**TFEE**	56.59
Compliance Check	See BREL	**% DFEE < TFEE**			-84.78
% DPER < TPER	-150.52	**DPER**	160.51	**TPER**	64.07

Assessor Details	Mr. Graham Suttill	**Assessor ID**	P035-0001
Client	Carnell Warren Associates Ltd, Wendy Warren		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	99.1000	(1a)	x 2.6900	(2a) =	266.5790	(1a) - (3a)
Ground floor	69.6600	(1b)	x 3.2200	(2b) =	224.3052	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		490.8842	(5)

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.5813	(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	0.7411	0.7266	0.7120	0.6394	0.6248	0.5522	0.5522	0.5377	0.5813	0.6248	0.6539	0.6830	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6000	(23c)

Effective ac	0.8631	0.8486	0.8340	0.7614	0.7468	0.6742	0.6742	0.6597	0.7032	0.7468	0.7759	0.8050	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Entrance Door			2.8800	1.6000	4.6080			(26)
Windows (Uw = 1.60)			28.5800	1.5038	42.9774			(27)
Glazed Doors (Uw = 1.60)			6.0200	1.5038	9.0526			(27)
Glazed Wall (Uw = 1.60)			27.7200	1.5038	41.6842			(27)
GF RL			2.9500	1.5038	4.4361			(27a)
1F RL			7.1700	1.5038	10.7820			(27a)
Basement Floor			77.2700	0.2500	19.3175	110.0000	8499.7000	(28)
Basement Floor 2			21.8700	0.2500	5.4675	110.0000	2405.7000	(28)
Retaining Wall	92.3800		92.3800	0.3000	27.7140	9.0000	831.4200	(29a)
External Wall	57.9400		57.9400	0.3000	17.3820	9.0000	521.4600	(29a)
New External Wall	108.5300	65.2000	43.3300	0.1800	7.7994	150.0000	6499.5000	(29a)
Flat Roof GF	30.4900	2.9500	27.5400	0.1500	4.1310	9.0000	247.8600	(30)
Flat Roof First Floor	69.6600	7.1700	62.4900	0.1500	9.3735	9.0000	562.4100	(30)
Total net area of external elements Aum(A, m2)			458.1400					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	204.7252			(33)
Party Wall 1	52.9900	0.0000	0.0000	70.0000	3709.3000 (32)
Internal Wall 1	265.7400			75.0000	19930.5000 (32c)
Internal Floor 1	68.2000			18.0000	1227.6000 (32d)
Internal Ceiling 1	68.2000			9.0000	613.8000 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =				45049.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					266.9427 (35)
Thermal bridges (Default value 0.200 * total exposed area)					91.6280 (36)
Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	296.3532 (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	139.8141	137.4602	135.1062	123.3365	120.9826	109.2128	109.2128	106.8589	113.9207	120.9826	125.6904	130.3983	(38)
Heat transfer coeff	436.1673	433.8134	431.4594	419.6897	417.3358	405.5661	405.5661	403.2121	410.2740	417.3358	422.0437	426.7516	(39)
Average = Sum(39)m / 12 =												419.1012	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.5845	2.5706	2.5566	2.4869	2.4730	2.4032	2.4032	2.3893	2.4311	2.4730	2.5009	2.5287	(40)
HLP (average)												2.4834	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9609	(42)
Hot water usage for mixer showers	83.0977	81.8489	80.0291	76.5474	73.9779	71.1125	69.4838	71.2898	73.2695	76.3460	79.9026	82.7793	(42a)
Hot water usage for baths	31.8874	31.4138	30.7469	29.5173	28.5966	27.5756	27.0242	27.6864	28.4075	29.4999	30.7548	31.7796	(42b)
Hot water usage for other uses	44.9527	43.3180	41.6834	40.0488	38.4141	36.7795	36.7795	38.4141	40.0488	41.6834	43.3180	44.9527	(42c)
Average daily hot water use (litres/day)												147.0440	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.9377	156.5807	152.4594	146.1134	140.9886	135.4676	133.2875	137.3903	141.7257	147.5293	153.9755	159.5116	(44)
Energy conte	253.3023	222.9689	234.3245	200.0220	189.7978	166.5732	161.1996	170.1179	174.7619	200.1959	219.3663	249.7565	(45)
Energy content (annual)										Total = Sum(45)m =		2442.3868	
Distribution loss (46)m = 0.15 x (45)m	37.9953	33.4453	35.1487	30.0033	28.4697	24.9860	24.1799	25.5177	26.2143	30.0294	32.9049	37.4635	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9720	(55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	306.6967	271.1961	287.7189	251.6940	243.1922	218.2452	214.5940	223.5123	226.4339	253.5903	271.0383	303.1509	(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	306.6967	271.1961	287.7189	251.6940	243.1922	218.2452	214.5940	223.5123	226.4339	253.5903	271.0383	303.1509	(64)
										Total per year (kWh/year) = Sum(64)m =		3071.0628	(64)
12Total per year (kWh/year)												3071	(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	126.9385	112.7189	120.6284	107.8449	105.8233	96.7232	96.3144	99.2797	99.4459	109.2807	114.2769	125.7596	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	171.6337	190.0230	171.6337	177.3548	171.6337	177.3548	171.6337	171.6337	177.3548	171.6337	177.3548	171.6337	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.2829	343.8140	334.9158	315.9726	292.0603	269.5860	254.5718	251.0407	259.9389	278.8821	302.7945	325.2687	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	(71)
Water heating gains (Table 5)	170.6163	167.7365	162.1350	149.7846	142.2356	134.3378	129.4548	133.4405	138.1194	146.8826	158.7179	169.0317	(72)
Total internal gains	752.9465	771.9871	739.0981	713.5257	676.3432	648.6922	623.0740	623.5285	642.8267	667.8120	709.2808	736.3477	(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	7.8500	10.6334	0.6300	0.7000	0.5400	17.8902	(74)
East	17.3900	19.6403	0.6300	0.7000	0.5400	73.2018	(76)
West	3.3400	19.6403	0.6300	0.7000	0.5400	14.0595	(80)
North	6.0200	10.6334	0.6300	0.7000	0.5400	13.7197	(74)
North	20.2300	10.6334	0.6300	0.7000	0.5400	46.1044	(74)
West	7.4900	19.6403	0.6300	0.7000	0.5400	31.5285	(80)
East	7.1700	26.0000	0.6300	0.7000	1.0000	73.9901	(82)

West				2.9500	26.0000	0.6300	0.7000	1.0000				30.4422	(82)
Solar gains	300.9365	597.7920	1020.6549	1565.9930	2001.2700	2088.1126	1971.5485	1636.2395	1210.4253	717.6226	376.5363	246.8226	(83)
Total gains	1053.8830	1369.7791	1759.7530	2279.5186	2677.6131	2736.8048	2594.6225	2259.7680	1853.2520	1385.4346	1085.8171	983.1704	(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	28.6901	28.8458	29.0031	29.8165	29.9847	30.8549	30.8549	31.0350	30.5008	29.9847	29.6502	29.3231	
alpha	2.9127	2.9231	2.9335	2.9878	2.9990	3.0570	3.0570	3.0690	3.0334	2.9990	2.9767	2.9549	
util living area	0.9969	0.9931	0.9825	0.9475	0.8683	0.7332	0.6002	0.6755	0.8833	0.9776	0.9946	0.9976	(86)
MIT	18.6362	18.8534	19.2487	19.8253	20.3249	20.6806	20.8151	20.7776	20.4568	19.7988	19.1423	18.6364	(87)
Th 2	18.9721	18.9801	18.9881	19.0285	19.0367	19.0781	19.0781	19.0865	19.0614	19.0367	19.0203	19.0041	(88)
util rest of house	0.9956	0.9902	0.9744	0.9214	0.7978	0.5850	0.3740	0.4518	0.7862	0.9621	0.9918	0.9965	(89)
MIT 2	16.3495	16.6318	17.1393	17.8831	18.4681	18.8465	18.9326	18.9283	18.6566	17.8721	17.0281	16.3698	(90)
Living area fraction									fLA = Living area / (4) =			0.1647	(91)
MIT	16.7262	16.9978	17.4868	18.2030	18.7740	19.1486	19.2427	19.2329	18.9532	18.1895	17.3764	16.7431	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.5762	16.8478	17.3368	18.0530	18.6240	18.9986	19.0927	19.0829	18.8032	18.0395	17.2264	16.5931	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9849	0.9637	0.9023	0.7777	0.5774	0.3760	0.4513	0.7670	0.9487	0.9873	0.9944	(94)
Useful gains	1046.4317	1349.0600	1695.9538	2056.8212	2082.4988	1580.1651	975.5941	1019.9037	1421.5095	1314.3891	1072.0437	977.6157	(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	5354.4591	5183.1064	4675.6478	3841.4366	2889.6282	1783.9407	1010.9581	1081.7941	1929.5937	3104.7489	4273.7793	5288.7932	(97)
Space heating kWh	3205.1724	2576.4791	2216.8923	1284.9230	600.5043	0.0000	0.0000	0.0000	0.0000	1332.0276	2305.2496	3207.5161	(98a)
Space heating requirement - total per year (kWh/year)												16728.7644	
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	3205.1724	2576.4791	2216.8923	1284.9230	600.5043	0.0000	0.0000	0.0000	0.0000	1332.0276	2305.2496	3207.5161	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16728.7644	
Space heating per m2											(98c) / (4) =	99.1275	(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 %)												88.8000	(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	3205.1724	2576.4791	2216.8923	1284.9230	600.5043	0.0000	0.0000	0.0000	0.0000	1332.0276	2305.2496	3207.5161	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	3609.4283	2901.4405	2496.5003	1446.9854	676.2436	0.0000	0.0000	0.0000	0.0000	1500.0311	2596.0018	3612.0676	(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	306.6967	271.1961	287.7189	251.6940	243.1922	218.2452	214.5940	223.5123	226.4339	253.5903	271.0383	303.1509	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.9339	87.8564	87.6642	87.1893	86.0041	79.8000	79.8000	79.8000	79.8000	87.2267	87.7587	87.9435	(217)
Fuel for water heating, kWh/month	348.7809	308.6812	328.2056	288.6753	282.7681	273.4903	268.9148	280.0906	283.7518	290.7257	308.8448	344.7109	(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	67.1198	60.6243	67.1198	64.9546	67.1198	64.9546	67.1198	67.1198	64.9546	67.1198	64.9546	67.1198	(231)
Lighting	42.6002	34.1755	30.7712	22.5443	17.4139	14.2273	15.8855	20.6486	26.8205	35.1899	39.7469	43.7842	(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												18838.6987	(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												3607.6400	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)		
mechanical ventilation fans (SFP = 1.1760)	704.2814	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	790.2814	(231)
Electricity for lighting (calculated in Appendix L)	343.8080	(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	23580.4280	(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	18838.6987	0.2100	3956.1267	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3607.6400	0.2100	757.6044	(264)
Space and water heating			4713.7311	(265)
Pumps, fans and electric keep-hot	790.2814	0.1387	109.6218	(267)
Energy for lighting	343.8080	0.1443	49.6221	(268)
Total CO2, kg/year			4872.9750	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			28.8800	(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	18838.6987	1.1300	21287.7295	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3607.6400	1.1300	4076.6332	(278)
Space and water heating			25364.3627	(279)
Pumps, fans and electric keep-hot	790.2814	1.5128	1195.5377	(281)
Energy for lighting	343.8080	1.5338	527.3442	(282)
Total Primary energy kWh/year			27087.2445	(286)
Dwelling Primary energy Rate (DPER)			160.5100	(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)	
Basement floor	99.1000	(1a) x	2.6900	(2a) =	266.5790	(1a) - (3a)
Ground floor	69.6600	(1b) x	3.2200	(2b) =	224.3052	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	168.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		490.8842	(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) = 0.0815	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3315	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2569	(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	0.3275	0.3211	0.3147	0.2826	0.2762	0.2441	0.2441	0.2376	0.2569	0.2762	0.2890	0.3019	(22b)
Effective ac	0.5536	0.5516	0.5495	0.5399	0.5381	0.5298	0.5298	0.5282	0.5330	0.5381	0.5418	0.5456	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.8800	1.0000	2.8800			(26)
TER Opening Type (Uw = 1.20)			33.8200	1.1450	38.7252			(27)
GF RL			1.6000	2.0221	3.2353			(27a)
1F RL			3.8900	2.0221	7.8658			(27a)
Basement Floor			77.2700	0.1300	10.0451			(28)
Basement Floor 2			21.8700	0.1300	2.8431			(28)
Retaining Wall	92.3800		92.3800	0.1800	16.6284			(29a)
External Wall	57.9400		57.9400	0.1800	10.4292			(29a)
New External Wall	108.5300	36.7000	71.8300	0.1800	12.9294			(29a)
Flat Roof GF	30.4900	1.6000	28.8900	0.1100	3.1779			(30)
Flat Roof First Floor	69.6600	3.8900	65.7700	0.1100	7.2347			(30)
Total net area of external elements Aum(A, m2)			458.1400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		115.9941			(33)
Party Wall 1			52.9900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	266.9427	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	22.9070	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	138.9011	(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	89.6858	89.3484	89.0176	87.4641	87.1734	85.8203	85.8203	85.5697	86.3415	87.1734	87.7614	88.3762	(38)
Heat transfer coeff	228.5869	228.2495	227.9187	226.3652	226.0745	224.7214	224.7214	224.4708	225.2426	226.0745	226.6625	227.2772	(39)
Average = Sum(39)m / 12 =												226.3638	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3545	1.3525	1.3505	1.3413	1.3396	1.3316	1.3316	1.3301	1.3347	1.3396	1.3431	1.3467	(40)
HLP (average)												1.3413	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9609	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.8646	72.7545	71.1370	68.0421	65.7582	63.2111	61.7634	63.3687	65.1284	67.8631	71.0245	73.5816	(42a)

Hot water usage for baths

31.8874	31.4138	30.7469	29.5173	28.5966	27.5756	27.0242	27.6864	28.4075	29.4999	30.7548	31.7796	(42b)

Hot water usage for other uses

44.9527	43.3180	41.6834	40.0488	38.4141	36.7795	36.7795	38.4141	40.0488	41.6834	43.3180	44.9527	(42c)

Average daily hot water use (litres/day)	138.5314	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.7047	147.4864	143.5673	137.6082	132.7689	127.5662	125.5670	129.4692	133.5846	139.0464	145.0974	150.3139	(44)
Energy conte	238.6793	210.0187	220.6576	188.3787	178.7324	156.8576	151.8624	160.3099	164.7232	188.6847	206.7178	235.3552	(45)
Energy content (annual)										Total = Sum(45)m =		2300.9776	
Distribution loss (46)m = 0.15 x (45)m	35.8019	31.5028	33.0986	28.2568	26.8099	23.5286	22.7794	24.0465	24.7085	28.3027	31.0077	35.3033	(46)

Water storage loss:		
Store volume	300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.1127	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.1409	(55)

Total storage loss

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)

If cylinder contains dedicated solar storage

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(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

297.3082	262.9737	279.2864	245.1163	237.3612	213.5951	210.4913	218.9387	221.4607	247.3135	263.4554	293.9840	(62)
WWHRS -33.7678	-29.8645	-31.2724	-25.8948	-24.1330	-20.6508	-19.3568	-20.5840	-21.3661	-25.1883	-28.5353	-33.1425	(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

263.5404	233.1092	248.0140	219.2215	213.2282	192.9443	191.1344	198.3547	200.0946	222.1252	234.9201	260.8415	(64)
								Total per year (kWh/year) = Sum(64)m =			2677.5283	(64)
12Total per year (kWh/year)											2678	(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

126.2639	112.1953	120.2717	108.0260	106.3316	97.5452	97.3973	100.2061	100.1605	109.6407	114.1237	125.1586	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	148.0455	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	172.7571	191.2668	172.7571	178.5157	172.7571	178.5157	172.7571	172.7571	178.5157	172.7571	178.5157	172.7571	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.2829	343.8140	334.9158	315.9726	292.0603	269.5860	254.5718	251.0407	259.9389	278.8821	302.7945	325.2687	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	37.8046	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	-118.4364	(71)
Water heating gains (Table 5)	169.7096	166.9572	161.6555	150.0361	142.9188	135.4794	130.9104	134.6856	139.1118	147.3666	158.5052	168.2240	(72)
Total internal gains	753.1633	772.4517	739.7421	714.9381	678.1498	650.9948	625.6530	625.8972	644.9801	669.4195	710.2290	736.6635	(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	18.5100	10.6334	0.6300	0.7000	0.5400	42.1845	(74)
East	9.4400	19.6403	0.6300	0.7000	0.5400	39.7369	(76)
West	5.8700	19.6403	0.6300	0.7000	0.5400	24.7093	(80)
East	3.8900	26.0000	0.6300	0.7000	1.0000	40.1425	(82)
West	1.6000	26.0000	0.6300	0.7000	1.0000	16.5110	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	163.2842	324.3522	553.7899	849.6859	1085.8692	1132.9936	1069.7450	887.8034	656.7571	389.3697	204.3033	133.9231	(83)
Total gains	916.4475	1096.8039	1293.5320	1564.6239	1764.0191	1783.9884	1695.3980	1513.7005	1301.7372	1058.7892	914.5323	870.5866	(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	54.7436	54.8246	54.9041	55.2809	55.3520	55.6853	55.6853	55.7475	55.5565	55.3520	55.2084	55.0591	
alpha	4.6496	4.6550	4.6603	4.6854	4.6901	4.7124	4.7124	4.7165	4.7038	4.6901	4.6806	4.6706	
util living area	0.9990	0.9975	0.9923	0.9676	0.8881	0.7262	0.5631	0.6419	0.8891	0.9868	0.9978	0.9992	(86)
MIT	19.3102	19.4967	19.8222	20.2850	20.6872	20.9166	20.9801	20.9644	20.7682	20.2374	19.6943	19.2809	(87)
Th 2	19.7984	19.7999	19.8014	19.8086	19.8099	19.8162	19.8162	19.8173	19.8138	19.8099	19.8072	19.8044	(88)
util rest of house	0.9986	0.9965	0.9891	0.9533	0.8398	0.6228	0.4219	0.4964	0.8199	0.9789	0.9968	0.9989	(89)
MIT 2	17.8350	18.0748	18.4913	19.0764	19.5462	19.7703	19.8105	19.8056	19.6491	19.0267	18.3334	17.8016	(90)
Living area fraction									fLA = Living area / (4) =			0.1647	(91)
MIT	18.0780	18.3090	18.7105	19.2755	19.7342	19.9592	20.0032	19.9965	19.8334	19.2261	18.5576	18.0453	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0780	18.3090	18.7105	19.2755	19.7342	19.9592	20.0032	19.9965	19.8334	19.2261	18.5576	18.0453	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9847	0.9447	0.8361	0.6366	0.4452	0.5201	0.8214	0.9731	0.9951	0.9982	(94)
Useful gains	914.3564	1090.8595	1273.7911	1478.1649	1474.8580	1135.6089	754.8058	787.3249	1069.2191	1030.3213	910.0422	869.0270	(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	3149.4788	3060.6073	2783.0063	2348.6490	1816.3192	1204.3173	764.7692	807.3022	1291.4156	1950.1431	2597.0062	3146.7176	(97)
Space heating kWh	1662.9311	1323.6705	1122.8561	626.7486	254.0471	0.0000	0.0000	0.0000	0.0000	684.3475	1214.6141	1694.6018	(98a)
Space heating requirement - total per year (kWh/year)												8583.8168	
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	1662.9311	1323.6705	1122.8561	626.7486	254.0471	0.0000	0.0000	0.0000	0.0000	684.3475	1214.6141	1694.6018	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8583.8168	
Space heating per m2											(98c) / (4) =	50.8640	(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	1662.9311	1323.6705	1122.8561	626.7486	254.0471	0.0000	0.0000	0.0000	0.0000	684.3475	1214.6141	1694.6018	(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)	1801.6588	1434.0959	1216.5288	679.0342	275.2407	0.0000	0.0000	0.0000	0.0000	741.4382	1315.9416	1835.9717	(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	263.5404	233.1092	248.0140	219.2215	213.2282	192.9443	191.1344	198.3547	200.0946	222.1252	234.9201	260.8415	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4508	87.3253	87.0243	86.2784	84.4536	79.8000	79.8000	79.8000	79.8000	86.4119	87.2060	87.4839	(217)
Fuel for water heating, kWh/month	301.3586	266.9436	284.9939	254.0861	252.4797	241.7849	239.5168	248.5648	250.7452	257.0540	269.3852	298.1596	(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	35.8955	28.7967	25.9283	18.9962	14.6732	11.9881	13.3854	17.3988	22.5993	29.6515	33.4913	36.8932	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-81.0123	-108.7272	-148.8139	-158.9738	-164.5703	-151.0368	-148.9311	-143.7018	-133.8299	-119.9718	-86.9823	-70.6797	(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	-64.0896	-132.1894	-258.1294	-381.3224	-498.3437	-498.7948	-493.1267	-420.3537	-311.7816	-187.1070	-84.8924	-50.9041	(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	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	9299.9099	(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	3165.0722	(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)	289.6974	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4898.2658	(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	7942.4138	(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	9299.9099	0.2100	1952.9811	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3165.0722	0.2100	664.6652	(264)
Space and water heating			2617.6463	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	289.6974	0.1443	41.8123	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1517.2309	0.1357	-205.8753	
PV Unit electricity exported	-3381.0349	0.1264	-427.3033	
Total			-633.1787	(269)
Total CO2, kg/year			2038.2092	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0800	(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	9299.9099	1.1300	10508.8982	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3165.0722	1.1300	3576.5316	(278)
Space and water heating			14085.4298	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	289.6974	1.5338	444.3476	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1517.2309	1.5016	-2278.2035	
PV Unit electricity exported	-3381.0349	0.4639	-1568.5681	
Total			-3846.7716	(283)
Total Primary energy kWh/year			10813.1066	(286)
Target Primary Energy Rate (TPER)			64.0700	(287)