Full SAP Calculation Printout

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

SAP Rating	70 C	**DER**	30.27	**TER**	18.38
Environmental	74 C	**% DER < TER**			-64.69
CO_2 Emissions (t/year)	2.34	**DFEE**	73.31	**TFEE**	36.94
Compliance Check	See BREL	**% DFEE < TFEE**			-98.48
% DPER < TPER	-70.09	**DPER**	168.27	**TPER**	98.93

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	91.1600	(1b)	x 2.5100	(2b) =	228.8116	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		228.8116	(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		6.0000 (17)
Infiltration rate		0.3000 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2100 (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	0.2677	0.2625	0.2573	0.2310	0.2257	0.1995	0.1995	0.1943	0.2100	0.2257	0.2362	0.2467	(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) =		79.2000 (23c)

Effective ac	0.3717	0.3665	0.3613	0.3350	0.3297	0.3035	0.3035	0.2983	0.3140	0.3297	0.3402	0.3508	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.40)			12.0300	1.3258	15.9489			(27)
Glazed Doors (Uw = 1.40)			18.2200	1.3258	24.1553			(27)
RL			1.1500	1.3258	1.5246			(27a)
Basement Floor			91.1600	0.2500	22.7900	110.0000	10027.6000	(28a)
Retaining Walls	21.8400		21.8400	0.3000	6.5520	9.0000	196.5600	(29a)
Wall to Lightwells	59.2100	27.4600	31.7500	0.3000	9.5250	9.0000	285.7500	(29a)
New External Wall	4.2100	2.7900	1.4200	0.1800	0.2556	150.0000	213.0000	(29a)
Flat Roof	3.4400	1.1500	2.2900	0.1500	0.3435	9.0000	20.6100	(30)
Total net area of external elements Aum(A, m2)			179.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.0949			(33)
Wall to Corridor			30.0100	0.0000	0.0000	20.0000	600.2000	(32)
Party Ceiling 1			87.7200			30.0000	2631.6000	(32b)
Internal Wall 1			163.0800			75.0000	12231.0000	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		26206.3200	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 287.4761 (35)
Thermal bridges (Default value 0.200 * total exposed area) 35.9720 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 117.0669 (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	28.0700	27.6736	27.2772	25.2951	24.8987	22.9166	22.9166	22.5202	23.7095	24.8987	25.6915	26.4844	(38)
Heat transfer coeff	145.1369	144.7405	144.3441	142.3620	141.9656	139.9835	139.9835	139.5871	140.7763	141.9656	142.7584	143.5513	(39)

Average = Sum(39)m / 12 = 142.2629

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5921	1.5878	1.5834	1.5617	1.5573	1.5356	1.5356	1.5312	1.5443	1.5573	1.5660	1.5747	(40)
HLP (average)												1.5606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6413 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	77.0683	75.9101	74.2224	70.9933	68.6103	65.9527	64.4422	66.1171	67.9532	70.8065	74.1050	76.7730	(42a)
Hot water usage for baths	29.5827	29.1433	28.5246	27.3839	26.5297	25.5826	25.0710	25.6853	26.3542	27.3677	28.5320	29.4827	(42b)
Hot water usage for other uses	41.6792	40.1636	38.6480	37.1324	35.6168	34.1012	34.1012	35.6168	37.1324	38.6480	40.1636	41.6792	(42c)

Average daily hot water use (litres/day) 136.3724 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.3302	145.2170	141.3950	135.5095	130.7567	125.6365	123.6143	127.4192	131.4398	136.8223	142.8006	147.9349	(44)
Energy conte	234.9187	206.7871	217.3189	185.5058	176.0237	154.4847	149.5008	157.7716	162.0784	185.6665	203.4456	231.6303	(45)

Energy content (annual) Total = Sum(45)m = 2265.1323

Distribution loss (46)m = 0.15 x (45)m	35.2378	31.0181	32.5978	27.8259	26.4036	23.1727	22.4251	23.6657	24.3118	27.8500	30.5168	34.7445	(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 0.6000 (49)
Enter (49) or (54) in (55) 1.0800 (55)

Total storage loss	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)
If cylinder contains dedicated solar storage	33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(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	291.6611	258.0383	274.0613	240.4178	232.7661	209.3967	206.2432	214.5140	216.9904	242.4089	258.3576	288.3727	(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	291.6611	258.0383	274.0613	240.4178	232.7661	209.3967	206.2432	214.5140	216.9904	242.4089	258.3576	288.3727	(64)

Total per year (kWh/year) = Sum(64)m = 2933.2283 (64)

12Total per year (kWh/year) 2933 (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	123.5044	109.7577	117.6524	105.6103	103.9218	95.2958	95.1029	97.8530	97.8207	107.1280	111.5753	122.4110	(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	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.6555	134.6901	121.6555	125.7107	121.6555	125.7107	121.6555	121.6555	125.7107	121.6555	125.7107	121.6555	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1957	243.6986	237.3914	223.9643	207.0150	191.0851	180.4429	177.9400	184.2471	197.6742	214.6236	230.5535	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	(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)	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	(71)
Water heating gains (Table 5)	166.0005	163.3299	158.1350	146.6809	139.6798	132.3552	127.8265	131.5228	135.8621	143.9893	154.9657	164.5309	(72)
Total internal gains	591.4708	604.3375	579.8010	558.9750	530.9694	511.7700	492.5440	493.7374	508.4389	525.9381	557.9189	579.3589	(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	2.2500	10.6334	0.4000	0.7000	0.5400	3.2557	(74)
South	9.7800	46.7521	0.4000	0.7000	0.5400	62.2206	(78)
North	3.6100	10.6334	0.4000	0.7000	0.5400	5.2236	(74)
West	14.6100	19.6403	0.4000	0.7000	0.5400	39.0474	(80)
East	1.1500	26.0000	0.4000	0.7000	1.0000	7.5348	(82)

Solar gains	117.2821	210.1399	310.9555	417.8705	492.9425	499.0332	477.1985	420.5713	348.3342	238.9634	142.4639	99.0296	(83)
Total gains	708.7529	814.4774	890.7565	976.8455	1023.9120	1010.8033	969.7425	914.3087	856.7731	764.9015	700.3828	678.3885	(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	50.1563	50.2937	50.4318	51.1340	51.2767	52.0028	52.0028	52.1505	51.7099	51.2767	50.9920	50.7103	
alpha	4.3438	4.3529	4.3621	4.4089	4.4184	4.4669	4.4669	4.4767	4.4473	4.4184	4.3995	4.3807	
util living area													
	0.9966	0.9933	0.9860	0.9628	0.9024	0.7646	0.6019	0.6521	0.8637	0.9729	0.9934	0.9972	(86)
MIT	19.3157	19.5070	19.8072	20.2294	20.6092	20.8783	20.9681	20.9545	20.7714	20.2780	19.7312	19.2938	(87)
Th 2	19.6191	19.6223	19.6255	19.6416	19.6448	19.6609	19.6609	19.6642	19.6545	19.6448	19.6383	19.6319	(88)
util rest of house													
	0.9952	0.9906	0.9800	0.9451	0.8526	0.6509	0.4354	0.4870	0.7773	0.9564	0.9901	0.9961	(89)
MIT 2	17.7088	17.9549	18.3381	18.8754	19.3223	19.5967	19.6529	19.6510	19.5074	18.9458	18.2530	17.6894	(90)
Living area fraction										fLA = Living area / (4) =		0.3214	(91)
MIT	18.2253	18.4537	18.8102	19.3106	19.7359	20.0087	20.0756	20.0700	19.9137	19.3740	18.7281	18.2050	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2253	18.4537	18.8102	19.3106	19.7359	20.0087	20.0756	20.0700	19.9137	19.3740	18.7281	18.2050	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9871	0.9749	0.9394	0.8566	0.6839	0.4900	0.5411	0.7973	0.9518	0.9869	0.9943	(94)
Useful gains	703.8801	804.0052	868.3582	917.6402	877.1313	691.2990	475.1363	494.7042	683.0692	728.0488	691.2069	674.5240	(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													
	2021.0704	1961.7754	1776.9116	1482.0713	1140.8249	757.1234	486.5305	512.2834	818.4314	1245.6018	1660.0087	2010.4421	(97)
Space heating kWh													
	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231	(98a)
Space heating requirement - total per year (kWh/year)												5113.0732	
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													
	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5113.0732	
Space heating per m2											(98c) / (4) =	56.0890	(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	1315.8450	1035.8780	1060.8619	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7641	0.8468	0.8136	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1005.4367	877.2008	863.0777	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1164.8826	1118.0196	1050.9801	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	114.8011	179.1691	139.7994	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.6582	(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	18.8900	29.4815	23.0034	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												71.3750	(107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	979.9895	778.0216	675.9637	406.3904	196.1881	0.0000	0.0000	0.0000	0.0000	385.0595	697.5373	993.9231	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	1469.9843	1167.0324	1013.9455	609.5857	294.2821	0.0000	0.0000	0.0000	0.0000	577.5892	1046.3060	1490.8846	
Space heating requirement													
	1469.9843	1167.0324	1013.9455	609.5857	294.2821	0.0000	0.0000	0.0000	0.0000	577.5892	1046.3060	1490.8846	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	291.6611	258.0383	274.0613	240.4178	232.7661	209.3967	206.2432	214.5140	216.9904	242.4089	258.3576	288.3727	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	437.4917	387.0575	411.0919	360.6267	349.1492	314.0951	309.3649	321.7711	325.4857	363.6134	387.5364	432.5590	
Water heating fuel													
	437.4917	387.0575	411.0919	360.6267	349.1492	314.0951	309.3649	321.7711	325.4857	363.6134	387.5364	432.5590	(310)
Cooling System Energy Efficiency Ratio												2.6000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	7.2654	11.3391	8.8475	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	22.5706	20.3864	22.5706	21.8425	22.5706	21.8425	22.5706	22.5706	21.8425	22.5706	21.8425	22.5706	(331)
Lighting	28.6349	22.9720	20.6837	15.1538	11.7052	9.5633	10.6779	13.8795	18.0281	23.6539	26.7170	29.4308	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												7669.6099	(307)

Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	4399.8424	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	76.6961	(313)
Space cooling fuel	27.4519	(321)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9520)		
mechanical ventilation fans (SFP = 0.9520)	265.7509	(330a)
Total electricity for the above, kWh/year	265.7509	(331)
Electricity for lighting (calculated in Appendix L)	231.1003	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	12593.7554	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	12704.6866	0.2100	1695.3874	(367)
Electrical energy for heat distribution (space & water)	76.6961	0.0000	18.0709	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			2686.0551	(373)
Space and water heating			2686.0551	(376)
Space cooling	27.4519	0.1137	3.1214	(377)
Pumps, fans and electric keep-hot	265.7509	0.1387	36.8629	(378)
Energy for lighting	231.1003	0.1443	33.3549	(379)
Total CO2, kg/year			2759.3943	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			30.2700	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	12704.6866	1.1300	9122.7991	(467)
Electrical energy for heat distribution (space & water)	76.6961	0.0000	187.5691	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			14543.8650	(473)
Space and water heating			14543.8650	(476)
Space cooling	27.4519	1.4192	38.9590	(477)
Pumps, fans and electric keep-hot	265.7509	1.5128	402.0280	(478)
Energy for lighting	231.1003	1.5338	354.4693	(479)
Total Primary energy kWh/year			15339.3213	(483)
Dwelling Primary energy Rate (DPER)			168.2700	(484)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		91.1600 (1b)	x	2.5100 (2b)	=	228.8116	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	228.8116	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1311	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3811	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2668	(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													
	0.3401	0.3335	0.3268	0.2935	0.2868	0.2534	0.2534	0.2468	0.2668	0.2868	0.3001	0.3135	(22b)
Effective ac	0.5578	0.5556	0.5534	0.5431	0.5411	0.5321	0.5321	0.5304	0.5356	0.5411	0.5450	0.5491	(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 Opening Type (Uw = 1.20)			21.9500	1.1450	25.1336			(27)
RL			0.8300	2.0221	1.6783			(27a)
Basement Floor			91.1600	0.1300	11.8508			(28a)
Retaining Walls	21.8400		21.8400	0.1800	3.9312			(29a)
Wall to Lightwells	59.2100	19.9300	39.2800	0.1800	7.0704			(29a)
New External Wall	4.2100	2.0200	2.1900	0.1800	0.3942			(29a)
Flat Roof	3.4400	0.8300	2.6100	0.1100	0.2871			(30)
Total net area of external elements Aum(A, m2)			179.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.3456			(33)
Wall to Corridor			30.0100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	297.0987	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	8.9930	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	59.3386	(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	42.1219	41.9523	41.7861	41.0052	40.8591	40.1789	40.1789	40.0530	40.4409	40.8591	41.1546	41.4636	(38)
Heat transfer coeff													
	101.4605	101.2909	101.1247	100.3438	100.1976	99.5175	99.5175	99.3916	99.7795	100.1976	100.4932	100.8022	(39)
Average = Sum(39)m / 12 =												100.3431	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1130	1.1111	1.1093	1.1007	1.0991	1.0917	1.0917	1.0903	1.0946	1.0991	1.1024	1.1058	(40)
HLP (average)												1.1007	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6413	(42)

Hot water usage for mixer showers

68.5051	67.4756	65.9754	63.1051	60.9869	58.6247	57.2820	58.7708	60.4028	62.9391	65.8711	68.2427	(42a)

Hot water usage for baths

29.5827	29.1433	28.5246	27.3839	26.5297	25.5826	25.0710	25.6853	26.3542	27.3677	28.5320	29.4827	(42b)

Hot water usage for other uses

41.6792	40.1636	38.6480	37.1324	35.6168	34.1012	34.1012	35.6168	37.1324	38.6480	40.1636	41.6792	(42c)

Average daily hot water use (litres/day)	128.4774	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	139.7670	136.7826	133.1481	127.6214	123.1334	118.3084	116.4541	120.0729	123.8895	128.9549	134.5667	139.4045	(44)
Energy conte	221.3568	194.7766	204.6437	174.7073	165.7612	145.4740	140.8411	148.6753	152.7681	174.9905	191.7149	218.2738	(45)
Energy content (annual)										Total = Sum(45)m =		2133.9834	
Distribution loss (46)m = 0.15 x (45)m													
	33.2035	29.2165	30.6965	26.2061	24.8642	21.8211	21.1262	22.3013	22.9152	26.2486	28.7572	32.7411	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4400	(48)
Temperature factor from Table 2b												1.0000	(49)
Enter (49) or (54) in (55)												1.4400	(55)
Total storage loss													
	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(56)
If cylinder contains dedicated solar storage													
	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(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													
	265.9968	235.0966	249.2837	217.9073	210.4012	188.6740	185.4811	193.3153	195.9681	219.6305	234.9149	262.9138	(62)
WWHRS	-31.3177	-27.6976	-29.0033	-24.0159	-22.3820	-19.1524	-17.9523	-19.0905	-19.8158	-23.3607	-26.4648	-30.7377	(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													
	234.6791	207.3989	220.2803	193.8914	188.0192	169.5216	167.5288	174.2248	176.1523	196.2699	208.4501	232.1761	(64)
										Total per year (kWh/year) = Sum(64)m =		2368.5926	(64)
12Total per year (kWh/year)												2369	(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													
	109.3131	97.0192	103.7560	92.6502	90.8276	82.9301	82.5417	85.1465	85.3554	93.8964	98.3052	108.2880	(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	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	132.0634	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	122.2043	135.2976	122.2043	126.2778	122.2043	126.2778	122.2043	122.2043	126.2778	122.2043	126.2778	122.2043	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	241.1957	243.6986	237.3914	223.9643	207.0150	191.0851	180.4429	177.9400	184.2471	197.6742	214.6236	230.5535	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	36.2063	(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)													
	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	-105.6507	(71)
Water heating gains (Table 5)													
	146.9263	144.3738	139.4570	128.6808	122.0801	115.1807	110.9431	114.4443	118.5492	126.2048	136.5350	145.5484	(72)

Total internal gains	572.9453	585.9890	561.6718	541.5420	513.9185	495.1626	476.2093	477.2076	491.6931	508.7024	540.0554	560.9253	(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	4.2500	10.6334	0.6300	0.7000	0.5400	9.6858	(74)
South	7.1000	46.7521	0.6300	0.7000	0.5400	71.1433	(78)
West	10.6000	19.6403	0.6300	0.7000	0.5400	44.6198	(80)
East	0.8300	26.0000	0.6300	0.7000	1.0000	8.5651	(82)

Solar gains	134.0140	240.0994	355.2442	477.3282	563.0387	569.9790	545.0468	480.3961	397.9260	273.0198	162.7845	113.1601	(83)
Total gains	706.9593	826.0884	916.9160	1018.8701	1076.9572	1065.1416	1021.2561	957.6037	889.6191	781.7221	702.8399	674.0854	(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	74.1490	74.2732	74.3953	74.9743	75.0836	75.5967	75.5967	75.6925	75.3983	75.0836	74.8628	74.6333	
alpha	5.9433	5.9515	5.9597	5.9983	6.0056	6.0398	6.0398	6.0462	6.0266	6.0056	5.9909	5.9756	
util living area	0.9968	0.9913	0.9763	0.9205	0.7885	0.5869	0.4273	0.4746	0.7292	0.9487	0.9918	0.9975	(86)
MIT	19.9811	20.1639	20.4116	20.7150	20.9148	20.9878	20.9984	20.9972	20.9589	20.6900	20.2783	19.9476	(87)
Th 2	19.9902	19.9918	19.9932	20.0002	20.0015	20.0076	20.0076	20.0088	20.0053	20.0015	19.9989	19.9961	(88)
util rest of house	0.9955	0.9880	0.9673	0.8923	0.7278	0.5012	0.3318	0.3739	0.6426	0.9239	0.9881	0.9966	(89)
MIT 2	18.8169	19.0503	19.3619	19.7293	19.9380	20.0019	20.0072	20.0080	19.9820	19.7105	19.2026	18.7787	(90)
Living area fraction									fLA = Living area / (4) =			0.3214	(91)
MIT	19.1911	19.4082	19.6993	20.0461	20.2519	20.3188	20.3258	20.3259	20.2960	20.0253	19.5483	19.1544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1911	19.4082	19.6993	20.0461	20.2519	20.3188	20.3258	20.3259	20.2960	20.0253	19.5483	19.1544	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9855	0.9640	0.8938	0.7441	0.5286	0.3626	0.4064	0.6693	0.9246	0.9859	0.9955	(94)
Useful gains	702.8161	814.1339	883.8707	910.6887	801.3108	563.0290	370.2655	389.1855	595.4248	722.7793	692.9266	671.0354	(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	1510.8577	1469.5495	1334.7748	1118.4454	856.8836	569.1179	370.7855	390.2027	618.2318	944.3975	1250.9746	1507.4351	(97)
Space heating kWh	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813	(98a)
Space heating requirement - total per year (kWh/year)												2756.9859	
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	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2756.9859	
Space heating per m2											(98c) / (4) =	30.2434	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Boilers-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.5000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	601.1830	440.4393	335.4726	149.5849	41.3462	0.0000	0.0000	0.0000	0.0000	164.8840	401.7946	622.2813	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.50													
307a	901.7745	660.6590	503.2090	224.3773	62.0193	0.0000	0.0000	0.0000	0.0000	247.3259	602.6918	933.4220	
Space heating requirement	901.7745	660.6590	503.2090	224.3773	62.0193	0.0000	0.0000	0.0000	0.0000	247.3259	602.6918	933.4220	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	234.6791	207.3989	220.2803	193.8914	188.0192	169.5216	167.5288	174.2248	176.1523	196.2699	208.4501	232.1761	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.50													
310a	352.0187	311.0984	330.4205	290.8371	282.0288	254.2823	251.2932	261.3372	264.2284	294.4048	312.6752	348.2641	
Water heating fuel	352.0187	311.0984	330.4205	290.8371	282.0288	254.2823	251.2932	261.3372	264.2284	294.4048	312.6752	348.2641	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(331)
Lighting	25.3916	20.3701	18.3410	13.4374	10.3795	8.4801	9.4685	12.3075	15.9862	20.9748	23.6910	26.0974	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-11.9395	-18.3148	-28.6072	-35.0297	-40.3449	-38.5895	-38.0983	-34.6583	-29.1099	-22.1235	-13.6347	-10.1558	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	-2.8912	-6.3090	-12.9860	-20.1933	-27.4107	-27.8290	-27.5256	-22.9931	-16.4355	-9.2627	-3.9324	-2.2712	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)

Annual totals kWh/year		
Space heating fuel - community heating	4135.4788	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	3552.8888	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	41.3548	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	204.9251	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-500.6457	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	7392.6470	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367)
Space and Water heating from Boilers	8093.0186	0.2100	914.1585	(367)
Electrical energy for heat distribution (space & water)	41.3548	0.0000	11.4721	(372)
Overall CO2 factor for heat network			0.2225	(386)
Total CO2 associated with community systems			1711.0060	(373)
Space and water heating			1711.0060	(376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(378)
Energy for lighting	204.9251	0.1443	29.5770	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-320.6061	0.1329	-42.6040	
PV Unit electricity exported	-180.0396	0.1249	-22.4822	
Total			-65.0862	(380)
Total CO2, kg/year			1675.4968	(383)
EPC Target Carbon Dioxide Emission Rate (TER)			18.3800	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(467a)
Space and Water heating from Boilers	8093.0186	1.1300	4919.0432	(467)
Electrical energy for heat distribution (space & water)	41.3548	0.0000	119.3320	(472)
Overall CO2 factor for heat network			1.2050	(486)
Total CO2 associated with community systems			9264.4430	(473)
Space and water heating			9264.4430	(476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(478)
Energy for lighting	204.9251	1.5338	314.3210	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-320.6061	1.4910	-478.0320	
PV Unit electricity exported	-180.0396	0.4583	-82.5157	
Total			-560.5478	(480)
Total Primary energy kWh/year			9018.2162	(483)
Target Primary Energy Rate (TPER)			98.9300	(484)