Full SAP Calculation Printout

Property Reference	Flat 04_08 top N	**Issued on Date**	25/01/2024
Assessment Reference	Flat 04_08 top N BE GREEN	**Prop Type Ref**	SE_01_009 exposed floor W
Property			

SAP Rating	83 B	**DER**	3.20	**TER**	13.57
Environmental	97 A	**% DER < TER**			76.42
CO_2 Emissions (t/year)	0.21	**DFEE**	30.15	**TFEE**	30.76
Compliance Check	See BREL	**% DFEE < TFEE**			1.96
% DPER < TPER	54.31	**DPER**	33.74	**TPER**	73.84

Assessor Details	Miss Amy Webb	**Assessor ID**	V831-0001
Client			

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)	
Ground floor	70.9300	(1b)	x 2.5300	(2b) =	179.4529	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9300					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	179.4529	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(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) =	0.1162	(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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(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) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2802	0.2773	0.2744	0.2599	0.2570	0.2424	0.2424	0.2395	0.2482	0.2570	0.2628	0.2686	(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	
Window (Uw = 1.20)			9.4600	1.1450	10.8321			(27)
Int door			1.7000	1.1000	1.8700			(26)
External Wall 1	36.3500	11.1600	25.1900	0.1500	3.7785	14.0000	352.6600	(29a)
stair wall	10.2600		10.2600	0.1800	1.8468	14.0000	143.6400	(29a)
External Roof 1	70.9300		70.9300	0.1200	8.5116	9.0000	638.3700	(30)
Total net area of external elements Aum(A, m2)			117.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8390			(33)
Party Wall 1			36.9200	0.0000	0.0000	20.0000	738.4000	(32)
Party Floor			70.9300			40.0000	2837.2000	(32d)
Internal Wall 1			115.6200			9.0000	1040.5800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5750.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		81.0778 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E7 Party floor between dwellings (in blocks of flats)	19.2300	0.0400	0.7692	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.5900	0.0000	0.0000	
E16 Corner (normal)	10.1200	0.0900	0.9108	
E18 Party wall between dwellings	10.1200	0.0600	0.6072	
E17 Corner (inverted - internal area greater than external area)	7.5900	0.0000	0.0000	
E3 Sill	3.5000	0.0500	0.1750	
E9 Balcony between dwellings, wall insulation continuous	5.4300	0.1000	0.5430	
E1 Steel lintel with perforated steel base plate	6.0300	0.1000	0.6030	
E4 Jamb	19.6000	0.0500	0.9800	
E14 Flat roof	24.6600	0.0600	1.4796	
P4 Party wall - Roof (insulation at ceiling level)	14.5900	0.0600	0.8754	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)												6.9432	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	33.7822	(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	16.5944	16.4223	16.2502	15.3897	15.2175	14.3570	14.3570	14.1849	14.7012	15.2175	15.5618	15.9060	(38)
Heat transfer coeff	50.3766	50.2045	50.0324	49.1718	48.9997	48.1392	48.1392	47.9671	48.4834	48.9997	49.3439	49.6881	(39)
Average = Sum(39)m / 12 =												49.1288	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7102	0.7078	0.7054	0.6932	0.6908	0.6787	0.6787	0.6763	0.6835	0.6908	0.6957	0.7005	(40)
HLP (average)												0.6926	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2685	(42)
Hot water usage for mixer showers	62.2548	61.3192	59.9559	57.3475	55.4225	53.2758	52.0556	53.4086	54.8917	57.1966	59.8611	62.0162	(42a)
Hot water usage for baths	26.8948	26.4954	25.9329	24.8958	24.1192	23.2581	22.7930	23.3516	23.9597	24.8811	25.9396	26.8039	(42b)
Hot water usage for other uses	37.8616	36.4848	35.1080	33.7312	32.3545	30.9777	30.9777	32.3545	33.7312	35.1080	36.4848	37.8616	(42c)
Average daily hot water use (litres/day)												116.7522	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.0112	124.2994	120.9968	115.9745	111.8962	107.5116	105.8263	109.1146	112.5827	117.1858	122.2855	126.6817	(44)
Energy conte	201.1547	177.0007	185.9676	158.7633	150.6338	132.1981	127.9877	135.1067	138.8257	159.0200	174.2181	198.3530	(45)
Energy content (annual)											Total = Sum(45)m =	1939.2293	
Distribution loss (46)m = 0.15 x (45)m	30.1732	26.5501	27.8951	23.8145	22.5951	19.8297	19.1982	20.2660	20.8239	23.8530	26.1327	29.7529	(46)
Water storage loss:													
Store volume												110.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152	(51)
Volume factor from Table 2a												1.0294	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												1.0327	(55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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	256.4315	226.9281	241.2444	212.2570	205.9106	185.6917	183.2645	190.3835	192.3194	214.2968	227.7118	253.6298	(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	256.4315	226.9281	241.2444	212.2570	205.9106	185.6917	183.2645	190.3835	192.3194	214.2968	227.7118	253.6298	(64)
										Total per year (kWh/year) = Sum(64)m =		2590.0691	(64)
12Total per year (kWh/year)												2590	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	111.1054	98.7947	106.0557	95.5837	94.3072	86.7508	86.7774	89.1444	88.9545	97.0956	100.7225	110.1738	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.7089	115.9277	104.7089	108.1992	104.7089	108.1992	104.7089	104.7089	108.1992	104.7089	108.1992	104.7089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4578	201.5276	196.3119	185.2083	171.1920	158.0186	149.2180	147.1482	152.3639	163.4675	177.4839	190.6572	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	(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)	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	(71)
Water heating gains (Table 5)	149.3352	147.0159	142.5480	132.7552	126.7570	120.4872	116.6362	119.8178	123.5479	130.5048	139.8923	148.0831	(72)
Total internal gains	510.5292	521.4985	500.5960	483.1900	459.6851	443.7323	427.5905	428.7022	441.1384	455.7086	482.6027	500.4765	(73)

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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	5.6000	10.6334	0.4000	0.8500	0.7700	14.0305	(74)
South	3.8600	46.7521	0.4000	0.8500	0.7700	42.5207	(78)

Solar gains	56.5511	96.4509	134.2681	173.4413	203.0598	206.0809	196.7698	173.5748	147.4442	107.0283	67.7099	48.4383	(83)
Total gains	567.0804	617.9493	634.8641	656.6312	662.7449	649.8133	624.3602	602.2770	588.5826	562.7369	550.3126	548.9148	(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	31.7103	31.8191	31.9285	32.4873	32.6014	33.1842	33.1842	33.3032	32.9486	32.6014	32.3740	32.1497	
alpha	3.1140	3.1213	3.1286	3.1658	3.1734	3.2123	3.2123	3.2202	3.1966	3.1734	3.1583	3.1433	
util living area	0.8811	0.8478	0.8057	0.7213	0.6048	0.4504	0.3322	0.3571	0.5239	0.7214	0.8356	0.8887	(86)
MIT	19.6615	19.8845	20.1599	20.5206	20.7831	20.9387	20.9825	20.9777	20.8962	20.5903	20.1083	19.6345	(87)
Th 2	20.3318	20.3339	20.3361	20.3468	20.3490	20.3597	20.3597	20.3619	20.3554	20.3490	20.3447	20.3404	(88)
util rest of house	0.8708	0.8352	0.7895	0.6985	0.5735	0.4104	0.2860	0.3102	0.4833	0.6949	0.8203	0.8790	(89)
MIT 2	18.7541	19.0317	19.3735	19.8188	20.1270	20.3056	20.3473	20.3455	20.2596	19.9092	19.3215	18.7268	(90)
Living area fraction									fLA = Living area / (4) =			0.4703	(91)
MIT	19.1809	19.4328	19.7434	20.1489	20.4356	20.6034	20.6461	20.6429	20.5590	20.2295	19.6916	19.1537	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1809	19.4328	19.7434	20.1489	20.4356	20.6034	20.6461	20.6429	20.5590	20.2295	19.6916	19.1537	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8504	0.8162	0.7737	0.6913	0.5778	0.4258	0.3068	0.3310	0.4964	0.6897	0.8034	0.8589	(94)
Useful gains	482.2688	504.3461	491.2144	453.9225	382.9029	276.7078	191.5747	199.3814	292.1724	388.1425	442.1344	471.4631	(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	749.6483	729.6121	662.5965	553.1282	428.0408	288.9980	194.7756	203.5181	313.1531	471.8446	621.3168	743.0233	(97)
Space heating kWh	198.9304	151.3787	127.5082	71.4282	33.5826	0.0000	0.0000	0.0000	0.0000	62.2744	129.0113	202.0408	(98a)
Space heating requirement - total per year (kWh/year)												976.1546	
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	198.9304	151.3787	127.5082	71.4282	33.5826	0.0000	0.0000	0.0000	0.0000	62.2744	129.0113	202.0408	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												976.1546	
Space heating per m2											(98c) / (4) =	13.7622	(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 Heat pump-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												1.2300	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	198.9304	151.3787	127.5082	71.4282	33.5826	0.0000	0.0000	0.0000	0.0000	62.2744	129.0113	202.0408	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.23													
307a	244.6844	186.1958	156.8351	87.8566	41.3066	0.0000	0.0000	0.0000	0.0000	76.5975	158.6839	248.5102	
Space heating requirement	244.6844	186.1958	156.8351	87.8566	41.3066	0.0000	0.0000	0.0000	0.0000	76.5975	158.6839	248.5102	(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	256.4315	226.9281	241.2444	212.2570	205.9106	185.6917	183.2645	190.3835	192.3194	214.2968	227.7118	253.6298	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.23													
310a	315.4107	279.1216	296.7307	261.0761	253.2700	228.4008	225.4154	234.1717	236.5528	263.5850	280.0855	311.9646	
Water heating fuel	315.4107	279.1216	296.7307	261.0761	253.2700	228.4008	225.4154	234.1717	236.5528	263.5850	280.0855	311.9646	(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	13.5366	12.2266	13.5366	13.1000	13.5366	13.1000	13.5366	13.5366	13.1000	13.5366	13.1000	13.5366	(331)
Lighting	21.7564	17.4538	15.7152	11.5137	8.8935	7.2660	8.1129	10.5455	13.6975	17.9719	20.2992	22.3611	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-10.5632	-16.2683	-25.5773	-31.5492	-36.5424	-35.0688	-34.6270	-31.3863	-26.1774	-19.7349	-12.0861	-8.9772	(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												1200.6702	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3185.7850	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												12.0067	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)													
mechanical ventilation fans (SFP = 0.7280)												159.3829	(330a)
Total electricity for the above, kWh/year												159.3829	(331)
Electricity for lighting (calculated in Appendix L)												175.5869	(332)

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

PV generation	-288.5582	(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	4432.8668	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367)
Space and Water heating from Heat pump	1462.1517	0.1554	62.1908	(367)
Electrical energy for heat distribution (space & water)	12.0067	0.0000	6.3532	(372)
Overall CO2 factor for heat network			0.0497	(386)
Total CO2 associated with community systems			218.1250	(373)
Space and water heating			218.1250	(376)
Pumps, fans and electric keep-hot	159.3829	0.1387	22.1084	(378)
Energy for lighting	175.5869	0.1443	25.3426	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.5582	0.1328	-38.3062	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.3062	(380)
Total CO2, kg/year			227.2698	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2000	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			300.0000	(467a)
Space and Water heating from Heat pump	1462.1517	1.5753	630.4660	(467)
Electrical energy for heat distribution (space & water)	12.0067	0.0000	67.3647	(472)
Overall CO2 factor for heat network			0.5273	(486)
Total CO2 associated with community systems			2312.8535	(473)
Space and water heating			2312.8535	(476)
Pumps, fans and electric keep-hot	159.3829	1.5128	241.1144	(478)
Energy for lighting	175.5869	1.5338	269.3211	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.5582	1.4905	-430.1007	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-430.1007	(480)
Total Primary energy kWh/year			2393.1883	(483)
Dwelling Primary energy Rate (DPER)			33.7400	(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		70.9300 (1b)	x	2.5300 (2b)	=	179.4529	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	179.4529	(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) =	0.1672	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4172	(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) =	0.3233	(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													

	0.4122	0.4041	0.3961	0.3556	0.3476	0.3071	0.3071	0.2991	0.3233	0.3476	0.3637	0.3799	(22b)
Effective ac	0.5850	0.5817	0.5784	0.5632	0.5604	0.5472	0.5472	0.5447	0.5523	0.5604	0.5661	0.5722	(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	
TER Opaque door			1.7000	1.0000	1.7000			(26)
TER Opening Type (Uw = 1.20)			9.4600	1.1450	10.8321			(27)
External Wall 1	36.3500	11.1600	25.1900	0.1800	4.5342			(29a)
stair wall	10.2600		10.2600	0.1800	1.8468			(29a)
External Roof 1	70.9300		70.9300	0.1100	7.8023			(30)
Total net area of external elements Aum(A, m2)			117.5400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.7154			(33)
Party Wall 1			36.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	81.0778	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	19.2300	0.0700	1.3461
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.5900	0.0000	0.0000
E16 Corner (normal)	10.1200	0.0900	0.9108
E18 Party wall between dwellings	10.1200	0.0600	0.6072
E17 Corner (inverted - internal area greater than external area)	7.5900	-0.0900	-0.6831
E3 Sill	3.5000	0.0500	0.1750
E9 Balcony between dwellings, wall insulation continuous	5.4300	0.0200	0.1086
E1 Steel lintel with perforated steel base plate	6.0300	0.0500	0.3015
E4 Jamb	19.6000	0.0500	0.9800
E14 Flat roof	24.6600	0.0800	1.9728
P4 Party wall - Roof (insulation at ceiling level)	14.5900	0.1200	1.7508

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.4697	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	34.1851	(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	34.6412	34.4458	34.2543	33.3548	33.1865	32.4031	32.4031	32.2580	32.7048	33.1865	33.5270	33.8829	(38)
Heat transfer coeff	68.8263	68.6309	68.4394	67.5399	67.3716	66.5881	66.5881	66.4430	66.8899	67.3716	67.7120	68.0680	(39)
Average = Sum(39)m / 12 =												67.5390	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9703	0.9676	0.9649	0.9522	0.9498	0.9388	0.9388	0.9367	0.9430	0.9498	0.9546	0.9596	(40)
HLP (average)												0.9522	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2685	(42)
Hot water usage for mixer showers	62.2548	61.3192	59.9559	57.3475	55.4225	53.2758	52.0556	53.4086	54.8917	57.1966	59.8611	62.0162	(42a)
Hot water usage for baths	26.8948	26.4954	25.9329	24.8958	24.1192	23.2581	22.7930	23.3516	23.9597	24.8811	25.9396	26.8039	(42b)
Hot water usage for other uses	37.8616	36.4848	35.1080	33.7312	32.3545	30.9777	30.9777	32.3545	33.7312	35.1080	36.4848	37.8616	(42c)
Average daily hot water use (litres/day)												116.7522	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.0112	124.2994	120.9968	115.9745	111.8962	107.5116	105.8263	109.1146	112.5827	117.1858	122.2855	126.6817	(44)
Energy conte	201.1547	177.0007	185.9676	158.7633	150.6338	132.1981	127.9877	135.1067	138.8257	159.0200	174.2181	198.3530	(45)
Energy content (annual)										Total = Sum(45)m =		1939.2293	
Distribution loss (46)m = 0.15 x (45)m	30.1732	26.5501	27.8951	23.8145	22.5951	19.8297	19.1982	20.2660	20.8239	23.8530	26.1327	29.7529	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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	247.7496	219.0864	232.5625	203.8551	197.2287	177.2899	174.5826	181.7016	183.9175	205.6149	219.3099	244.9479	(62)
WWHRS	-28.4603	-25.1705	-26.3571	-21.8247	-20.3399	-17.4050	-16.3144	-17.3487	-18.0078	-21.2293	-24.0502	-27.9332	(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	219.2893	193.9159	206.2054	182.0304	176.8888	159.8849	158.2683	164.3529	165.9097	184.3856	195.2598	217.0147	(64)
										Total per year (kWh/year) = Sum(64)m =		2223.4057	(64)
12Total per year (kWh/year)												2223	(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	104.1598	92.5213	99.1102	88.8623	87.3617	80.0293	79.8318	82.1989	82.2330	90.1501	94.0010	103.2283	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	113.4245	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.0830	120.7704	109.0830	112.7191	109.0830	112.7191	109.0830	109.0830	112.7191	109.0830	112.7191	109.0830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4578	201.5276	196.3119	185.2083	171.1920	158.0186	149.2180	147.1482	152.3639	163.4675	177.4839	190.6572	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	34.3424	(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)													
	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	-90.7396	(71)
Water heating gains (Table 5)													
	139.9998	137.6805	133.2126	123.4198	117.4216	111.1518	107.3009	110.4824	114.2125	121.1694	130.5569	138.7477	(72)
Total internal gains													
	508.5679	520.0059	498.6348	481.3745	457.7239	438.9169	422.6292	423.7410	436.3229	453.7473	480.7872	498.5152	(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	5.6000	10.6334	0.6300	0.7000	0.7700	18.1983	(74)
South	3.8600	46.7521	0.6300	0.7000	0.7700	55.1518	(78)

Solar gains	73.3502	125.1024	174.1536	224.9635	263.3805	267.2991	255.2220	225.1367	191.2438	138.8220	87.8237	62.8273	(83)
Total gains	581.9181	645.1083	672.7884	706.3380	721.1043	706.2160	677.8511	648.8776	627.5667	592.5694	568.6109	561.3425	(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	23.2100	23.2761	23.3412	23.6521	23.7112	23.9901	23.9901	24.0425	23.8819	23.7112	23.5919	23.4686	
alpha	2.5473	2.5517	2.5561	2.5768	2.5807	2.5993	2.5993	2.6028	2.5921	2.5807	2.5728	2.5646	
util living area													
	0.9042	0.8763	0.8408	0.7707	0.6684	0.5266	0.4031	0.4334	0.6042	0.7781	0.8703	0.9109	(86)
MIT	18.8254	19.1148	19.5077	20.0406	20.4912	20.8081	20.9301	20.9136	20.7092	20.1567	19.4323	18.7839	(87)
Th 2	20.1081	20.1104	20.1127	20.1234	20.1254	20.1347	20.1347	20.1364	20.1311	20.1254	20.1213	20.1171	(88)
util rest of house													
	0.8940	0.8634	0.8237	0.7454	0.6302	0.4709	0.3324	0.3626	0.5510	0.7488	0.8548	0.9013	(89)
MIT 2	17.5659	17.9278	18.4187	19.0786	19.6141	19.9715	20.0891	20.0774	19.8701	19.2310	18.3381	17.5196	(90)
Living area fraction									fLA = Living area / (4) =			0.4703	(91)
MIT	18.1583	18.4860	18.9308	19.5311	20.0267	20.3649	20.4846	20.4707	20.2648	19.6664	18.8527	18.1142	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1583	18.4860	18.9308	19.5311	20.0267	20.3649	20.4846	20.4707	20.2648	19.6664	18.8527	18.1142	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8661	0.8350	0.7971	0.7263	0.6256	0.4863	0.3617	0.3908	0.5597	0.7316	0.8280	0.8740	(94)
Useful gains	503.9719	538.6975	536.2978	513.0165	451.1130	343.4451	245.1726	253.5780	351.2231	433.5057	470.8297	490.6011	(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													
	953.8151	932.4221	850.7587	718.0213	560.9798	383.8768	258.6697	270.4706	412.3605	610.8184	795.8003	947.1137	(97)
Space heating kWh													
	334.6833	264.5829	233.9589	147.6035	81.7409	0.0000	0.0000	0.0000	0.0000	131.9207	233.9788	339.6454	(98a)
Space heating requirement - total per year (kWh/year)												1768.1144	
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													
	334.6833	264.5829	233.9589	147.6035	81.7409	0.0000	0.0000	0.0000	0.0000	131.9207	233.9788	339.6454	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1768.1144	
Space heating per m2											(98c) / (4) =	24.9276	(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													
	334.6833	264.5829	233.9589	147.6035	81.7409	0.0000	0.0000	0.0000	0.0000	131.9207	233.9788	339.6454	(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)													
	362.6038	286.6553	253.4766	159.9171	88.5600	0.0000	0.0000	0.0000	0.0000	142.9260	253.4982	367.9799	(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													
	219.2893	193.9159	206.2054	182.0304	176.8888	159.8849	158.2683	164.3529	165.9097	184.3856	195.2598	217.0147	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0050	84.7571	84.3437	83.5937	82.4408	79.8000	79.8000	79.8000	79.8000	83.3220	84.4665	85.0601	(217)
Fuel for water heating, kWh/month													
	257.9723	228.7901	244.4824	217.7560	214.5647	200.3571	198.3312	205.9560	207.9069	221.2927	231.1683	255.1311	(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	22.6653	18.1829	16.3717	11.9946	9.2650	7.5696	8.4518	10.9860	14.2697	18.7227	21.1472	23.2952	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.8419	-12.1659	-19.2192	-23.8174	-27.7002	-26.6099	-26.2904	-23.7981	-19.8028	-14.8276	-9.0068	-6.6569	(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	-1.5995	-3.5099	-7.2596	-11.3383	-15.4339	-15.6729	-15.4866	-12.9036	-9.1920	-5.1532	-2.1767	-1.2542	(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	1915.6169	(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	2683.7087	(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)	182.9219	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-318.7175	(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	4549.5300	(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	1915.6169	0.2100	402.2796	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2683.7087	0.2100	563.5788	(264)
Space and water heating			965.8584	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.9219	0.1443	26.4013	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-217.7372	0.1326	-28.8820	
PV Unit electricity exported	-100.9804	0.1248	-12.5999	
Total			-41.4819	(269)
Total CO2, kg/year			962.7070	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5700	(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	1915.6169	1.1300	2164.6471	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2683.7087	1.1300	3032.5909	(278)
Space and water heating			5197.2380	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.9219	1.5338	280.5717	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-217.7372	1.4901	-324.4559	
PV Unit electricity exported	-100.9804	0.4580	-46.2446	
Total			-370.7005	(283)
Total Primary energy kWh/year			5237.2100	(286)
Target Primary Energy Rate (TPER)			73.8400	(287)