Full SAP Calculation Printout

Property Reference	Flat 02_03 exposed floor N	**Issued on Date**	25/01/2024
Assessment Reference	Flat 02_03 EF N - BE GREEN	**Prop Type Ref**	SE_01_009 exposed floor W
Property			

SAP Rating	82 B	**DER**	3.31	**TER**	14.40
Environmental	97 A	**% DER < TER**			77.01
CO_2 Emissions (t/year)	0.27	**DFEE**	37.03	**TFEE**	40.91
Compliance Check	See BREL	**% DFEE < TFEE**			9.47
% DPER < TPER	55.63	**DPER**	34.58	**TPER**	77.95

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	88.9700	(1b)	x 2.5300	(2b) =	225.0941	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.9700					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		225.0941	(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)			15.9700	1.1450	18.2863			(27)
Int door			1.7000	1.1000	1.8700			(26)
Exposed floor			88.9700	0.1200	10.6764			(28b)
External Wall 1	59.1500	15.9700	43.1800	0.1500	6.4770	14.0000	604.5200	(29a)
Corridor wall	45.1500	1.7000	43.4500	0.1800	7.8210	14.0000	608.3000	(29a)
Total net area of external elements Aum(A, m2)			193.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.1307			(33)
Party Wall 1			23.0700	0.0000	0.0000	20.0000	461.4000	(32)
Party Ceiling 1			88.9700			90.0000	8007.3000	(32b)
Internal Wall 1			167.6400			9.0000	1508.7600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11190.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	125.7759	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E7 Party floor between dwellings (in blocks of flats)	41.2300	0.0400	1.6492	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.1200	0.0000	0.0000	
E16 Corner (normal)	25.3000	0.0900	2.2770	
E18 Party wall between dwellings	5.0600	0.0600	0.3036	
E17 Corner (inverted - internal area greater than external area)	12.6500	0.0000	0.0000	
P7 Party Wall - Exposed floor (normal)	9.1200	0.2000	1.8240	
E20 Exposed floor (normal)	34.3800	0.1000	3.4380	
E1 Steel lintel with perforated steel base plate	11.3200	0.1000	1.1320	
E4 Jamb	25.8000	0.0500	1.2900	
E3 Sill	9.5900	0.0500	0.4795	
E9 Balcony between dwellings, wall insulation continuous	6.8500	0.1000	0.6850	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.0783 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 58.2090 (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	20.8149	20.5991	20.3832	19.3038	19.0879	18.0085	18.0085	17.7926	18.4403	19.0879	19.5197	19.9514	(38)
Heat transfer coeff	79.0239	78.8080	78.5921	77.5127	77.2969	76.2175	76.2175	76.0016	76.6492	77.2969	77.7286	78.1604	(39)
Average = Sum(39)m / 12 =												77.4588	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8882	0.8858	0.8834	0.8712	0.8688	0.8567	0.8567	0.8542	0.8615	0.8688	0.8736	0.8785	(40)
HLP (average)												0.8706	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6114 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	68.0036	66.9817	65.4925	62.6432	60.5404	58.1955	56.8626	58.3406	59.9607	62.4784	65.3889	67.7431	(42a)
Hot water usage for baths	29.3670	28.9309	28.3167	27.1843	26.3363	25.3961	24.8882	25.4981	26.1621	27.1682	28.3240	29.2677	(42b)
Hot water usage for other uses	41.3729	39.8684	38.3640	36.8595	35.3550	33.8506	33.8506	35.3550	36.8595	38.3640	39.8684	41.3729	(42c)
Average daily hot water use (litres/day)												127.5367	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.7436	135.7810	132.1731	126.6869	122.2318	117.4421	115.6014	119.1937	122.9823	128.0106	133.5813	138.3837	(44)
Energy conte	219.7359	193.3503	203.1452	173.4281	164.5475	144.4088	139.8099	147.5867	151.6495	173.7092	190.3111	216.6755	(45)
Energy content (annual)										Total = Sum(45)m =		2118.3576	
Distribution loss (46)m = 0.15 x (45)m	32.9604	29.0025	30.4718	26.0142	24.6821	21.6613	20.9715	22.1380	22.7474	26.0564	28.5467	32.5013	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	275.0127	243.2778	258.4220	226.9218	219.8243	197.9025	195.0867	202.8635	205.1431	228.9860	243.8048	271.9523	(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	275.0127	243.2778	258.4220	226.9218	219.8243	197.9025	195.0867	202.8635	205.1431	228.9860	243.8048	271.9523	(64)
										Total per year (kWh/year) = Sum(64)m =		2769.1973	(64)
12Total per year (kWh/year)												2769	(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	117.2836	104.2309	111.7672	100.4598	98.9335	90.8109	90.7082	93.2940	93.2184	101.9797	106.0734	116.2660	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	(66)m
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	119.7062	132.5319	119.7062	123.6964	119.7062	123.6964	119.7062	119.7062	123.6964	119.7062	123.6964	119.7062	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.1700	239.6311	233.4292	220.2262	203.5598	187.8957	177.4312	174.9701	181.1719	194.3749	211.0413	226.7054	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	(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)	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	(71)
Water heating gains (Table 5)	157.6393	155.1056	150.2248	139.5275	132.9751	126.1262	121.9197	125.3952	129.4700	137.0695	147.3241	156.2716	(72)
Total internal gains	576.6859	589.4389	565.5306	545.6205	518.4115	499.8887	481.2274	482.2418	496.5087	513.3211	544.2323	564.8536	(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	0.4000	0.8500	0.7700	14.0305	(74)
East	1.9100	19.6403	0.4000	0.8500	0.7700	8.8388	(76)

South			8.4600		46.7521		0.4000		0.8500		0.7700	93.1930	(78)
Solar gains	116.0623	196.7296	268.4554	334.4482	378.4586	377.9991	363.4407	329.8723	290.9908	217.0556	138.7948	99.4924	(83)
Total gains	692.7481	786.1685	833.9860	880.0687	896.8701	877.8878	844.6681	812.1141	787.4995	730.3766	683.0271	664.3460	(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	39.3351	39.4428	39.5512	40.1019	40.2139	40.7834	40.7834	40.8993	40.5537	40.2139	39.9906	39.7696	
alpha	3.6223	3.6295	3.6367	3.6735	3.6809	3.7189	3.7189	3.7266	3.7036	3.6809	3.6660	3.6513	
util living area	0.9515	0.9249	0.8874	0.8103	0.6923	0.5260	0.3892	0.4197	0.6119	0.8224	0.9224	0.9571	(86)
MIT	19.5776	19.8325	20.1382	20.5132	20.7877	20.9434	20.9856	20.9809	20.8979	20.5595	20.0254	19.5370	(87)
Th 2	20.1775	20.1796	20.1817	20.1920	20.1941	20.2045	20.2045	20.2066	20.2003	20.1941	20.1900	20.1858	(88)
util rest of house	0.9443	0.9142	0.8713	0.7839	0.6510	0.4688	0.3219	0.3513	0.5555	0.7923	0.9097	0.9507	(89)
MIT 2	18.5181	18.8372	19.2169	19.6768	19.9919	20.1610	20.1965	20.1954	20.1163	19.7411	19.0901	18.4731	(90)
Living area fraction										fLA = Living area / (4) =		0.2926	(91)
MIT	18.8281	19.1284	19.4865	19.9215	20.2248	20.3899	20.4274	20.4252	20.3450	19.9805	19.3638	18.7844	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8281	19.1284	19.4865	19.9215	20.2248	20.3899	20.4274	20.4252	20.3450	19.9805	19.3638	18.7844	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9296	0.8979	0.8557	0.7742	0.6527	0.4825	0.3410	0.3705	0.5661	0.7835	0.8941	0.9368	(94)
Useful gains	643.9469	705.8972	713.6382	681.3490	585.3551	423.6031	288.0263	300.8569	445.8132	572.2498	610.7149	622.3373	(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	1148.0665	1121.3108	1020.6332	854.3099	658.9366	441.2936	291.7137	305.9212	478.6724	725.0862	953.2458	1139.9216	(97)
Space heating kWh	375.0650	279.1580	228.4043	124.5319	54.7446	0.0000	0.0000	0.0000	0.0000	113.7103	246.6222	385.0827	(98a)
Space heating requirement - total per year (kWh/year)												1807.3189	
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	375.0650	279.1580	228.4043	124.5319	54.7446	0.0000	0.0000	0.0000	0.0000	113.7103	246.6222	385.0827	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1807.3189	
Space heating per m2											(98c) / (4) =	20.3138	(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	375.0650	279.1580	228.4043	124.5319	54.7446	0.0000	0.0000	0.0000	0.0000	113.7103	246.6222	385.0827	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.23													
307a	461.3299	343.3643	280.9373	153.1742	67.3359	0.0000	0.0000	0.0000	0.0000	139.8636	303.3454	473.6517	
Space heating requirement	461.3299	343.3643	280.9373	153.1742	67.3359	0.0000	0.0000	0.0000	0.0000	139.8636	303.3454	473.6517	(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	275.0127	243.2778	258.4220	226.9218	219.8243	197.9025	195.0867	202.8635	205.1431	228.9860	243.8048	271.9523	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.23													
310a	338.2656	299.2317	317.8591	279.1138	270.3839	243.4201	239.9566	249.5221	252.3261	281.6527	299.8799	334.5013	
Water heating fuel	338.2656	299.2317	317.8591	279.1138	270.3839	243.4201	239.9566	249.5221	252.3261	281.6527	299.8799	334.5013	(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	17.9591	16.2211	17.9591	17.3797	17.9591	17.3797	17.9591	17.9591	17.3797	17.9591	17.3797	17.9591	(331)
Lighting	24.8726	19.9537	17.9661	13.1627	10.1673	8.3068	9.2749	12.0559	15.6594	20.5460	23.2067	25.5639	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-13.1631	-20.2244	-31.7232	-39.0365	-45.1309	-43.2798	-42.7320	-38.7703	-32.3932	-24.4926	-15.0437	-11.1916	(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												2223.0023	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												3406.1127	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												22.2300	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700)													
mechanical ventilation fans (SFP = 0.7700)												211.4534	(330a)
Total electricity for the above, kWh/year												211.4534	(331)
Electricity for lighting (calculated in Appendix L)												200.7360	(332)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-357.1811	(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	5684.1234	(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	1876.3717	0.1556	115.3142	(367)
Electrical energy for heat distribution (space & water)	22.2300	0.0000	8.2588	(372)
Overall CO2 factor for heat network			0.0504	(386)
Total CO2 associated with community systems			283.5520	(373)
Space and water heating			283.5520	(376)
Pumps, fans and electric keep-hot	211.4534	0.1387	29.3312	(378)
Energy for lighting	200.7360	0.1443	28.9724	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-357.1811	0.1328	-47.4325	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-47.4325	(380)
Total CO2, kg/year			294.4231	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3100	(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	1876.3717	1.5761	1167.9096	(467)
Electrical energy for heat distribution (space & water)	22.2300	0.0000	86.8448	(472)
Overall CO2 factor for heat network			0.5297	(486)
Total CO2 associated with community systems			2981.6698	(473)
Space and water heating			2981.6698	(476)
Pumps, fans and electric keep-hot	211.4534	1.5128	319.8867	(478)
Energy for lighting	200.7360	1.5338	307.8956	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-357.1811	1.4907	-532.4466	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-532.4466	(480)
Total Primary energy kWh/year			3077.0055	(483)
Dwelling Primary energy Rate (DPER)			34.5800	(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		88.9700	(1b)	x 2.5300	(2b) =	225.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		225.0941	(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) =	0.1333	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3833	(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) =	0.2970	(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													
	0.3787	0.3713	0.3639	0.3267	0.3193	0.2822	0.2822	0.2748	0.2970	0.3193	0.3342	0.3490	(22b)
Effective ac	0.5717	0.5689	0.5662	0.5534	0.5510	0.5398	0.5398	0.5377	0.5441	0.5510	0.5558	0.5609	(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			1.7000	1.0000	1.7000			(26)
TER Opening Type (Uw = 1.20)			15.9700	1.1450	18.2863			(27)
Exposed floor			88.9700	0.1300	11.5661			(28b)
External Wall 1	59.1500	15.9700	43.1800	0.1800	7.7724			(29a)
Corridor wall	45.1500	1.7000	43.4500	0.1800	7.8210			(29a)
Total net area of external elements Aum(A, m2)			193.2700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.1458			(33)
Party Wall 1			23.0700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 99.7759 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	41.2300	0.0700	2.8861
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	9.1200	0.0000	0.0000
E16	Corner (normal)	25.3000	0.0900	2.2770
E18	Party wall between dwellings	5.0600	0.0600	0.3036
E17	Corner (inverted - internal area greater than external area)	12.6500	-0.0900	-1.1385
P7	Party Wall - Exposed floor (normal)	9.1200	0.1600	1.4592
E20	Exposed floor (normal)	34.3800	0.3200	11.0016
E1	Steel lintel with perforated steel base plate	11.3200	0.0500	0.5660
E4	Jamb	25.8000	0.0500	1.2900
E3	Sill	9.5900	0.0500	0.4795
E9	Balcony between dwellings, wall insulation continuous	6.8500	0.0200	0.1370

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.2615 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 66.4073 (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	42.4677	42.2609	42.0581	41.1057	40.9275	40.0980	40.0980	39.9444	40.4175	40.9275	41.2880	41.6649	(38)
Heat transfer coeff	108.8750	108.6681	108.4654	107.5130	107.3348	106.5053	106.5053	106.3517	106.8248	107.3348	107.6953	108.0721	(39)
Average = Sum(39)m / 12 =												107.5121	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2237	1.2214	1.2191	1.2084	1.2064	1.1971	1.1971	1.1954	1.2007	1.2064	1.2105	1.2147	(40)
HLP (average)												1.2084	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6114 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	68.0036	66.9817	65.4925	62.6432	60.5404	58.1955	56.8626	58.3406	59.9607	62.4784	65.3889	67.7431	(42a)
Hot water usage for baths	29.3670	28.9309	28.3167	27.1843	26.3363	25.3961	24.8882	25.4981	26.1621	27.1682	28.3240	29.2677	(42b)
Hot water usage for other uses	41.3729	39.8684	38.3640	36.8595	35.3550	33.8506	33.8506	35.3550	36.8595	38.3640	39.8684	41.3729	(42c)
Average daily hot water use (litres/day)												127.5367	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.7436	135.7810	132.1731	126.6869	122.2318	117.4421	115.6014	119.1937	122.9823	128.0106	133.5813	138.3837	(44)
Energy conte	219.7359	193.3503	203.1452	173.4281	164.5475	144.4088	139.8099	147.5867	151.6495	173.7092	190.3111	216.6755	(45)
Energy content (annual)										Total = Sum(45)m =		2118.3576	
Distribution loss (46)m = 0.15 x (45)m	32.9604	29.0025	30.4718	26.0142	24.6821	21.6613	20.9715	22.1380	22.7474	26.0564	28.5467	32.5013	(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	266.3308	235.4361	249.7401	218.5199	211.1424	189.5006	186.4048	194.1816	196.7413	220.3041	235.4029	263.2704	(62)
WWHRS	-31.0884	-27.4949	-28.7910	-23.8401	-22.2181	-19.0122	-17.8209	-18.9508	-19.6708	-23.1897	-26.2711	-30.5127	(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	235.2424	207.9412	220.9491	194.6798	188.9243	170.4884	168.5839	175.2308	177.0705	197.1144	209.1319	232.7577	(64)
									Total per year (kWh/year) = Sum(64)m =			2378.1143	(64)
12Total per year (kWh/year)												2378	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)
												0.0000	(64a)
Heat gains from water heating, kWh/month	110.3381	97.9576	104.8217	93.7383	91.9880	84.0894	83.7627	86.3485	86.4969	95.0342	99.3519	109.3205	(65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	130.5679	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.2343	135.3309	122.2343	126.3088	122.2343	126.3088	122.2343	122.2343	126.3088	122.2343	126.3088	122.2343	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.1700	239.6311	233.4292	220.2262	203.5598	187.8957	177.4312	174.9701	181.1719	194.3749	211.0413	226.7054	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	36.0568	(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)													
	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	-104.4543	(71)
Water heating gains (Table 5)													
	148.3039	145.7702	140.8894	130.1921	123.6397	116.7908	112.5843	116.0598	120.1346	127.7342	137.9888	146.9362	(72)
Total internal gains													
	572.8786	585.9025	561.7233	541.8975	514.6042	493.1657	474.4201	475.4346	489.7857	509.5138	540.5093	561.0463	(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)
East	1.9100	19.6403	0.6300	0.7000	0.7700	11.4644	(76)
South	8.4600	46.7521	0.6300	0.7000	0.7700	120.8768	(78)

Solar gains	150.5396	255.1699	348.2025	433.7991	490.8831	490.2870	471.4039	427.8637	377.4322	281.5339	180.0250	129.0475	(83)
Total gains	723.4182	841.0724	909.9258	975.6966	1005.4873	983.4528	945.8241	903.2983	867.2180	791.0477	720.5343	690.0938	(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	22.6485	22.6916	22.7340	22.9354	22.9734	23.1524	23.1524	23.1858	23.0831	22.9734	22.8966	22.8167	
alpha	2.5099	2.5128	2.5156	2.5290	2.5316	2.5435	2.5435	2.5457	2.5389	2.5316	2.5264	2.5211	
util living area													
	0.9380	0.9108	0.8754	0.8106	0.7142	0.5780	0.4498	0.4828	0.6570	0.8269	0.9115	0.9440	(86)
MIT	18.4496	18.7972	19.2603	19.8527	20.3696	20.7443	20.9024	20.8800	20.6226	19.9596	19.1113	18.3868	(87)
Th 2	19.9011	19.9029	19.9047	19.9133	19.9149	19.9223	19.9223	19.9237	19.9195	19.9149	19.9116	19.9083	(88)
util rest of house													
	0.9291	0.8983	0.8575	0.7821	0.6684	0.5063	0.3543	0.3878	0.5909	0.7949	0.8970	0.9360	(89)
MIT 2	16.9535	17.3888	17.9671	18.6980	19.3091	19.7226	19.8680	19.8529	19.6033	18.8432	17.7961	16.8789	(90)
Living area fraction									fLA = Living area / (4) =			0.2926	(91)
MIT	17.3912	17.8009	18.3454	19.0358	19.6194	20.0215	20.1707	20.1534	19.9015	19.1698	18.1809	17.3200	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3912	17.8009	18.3454	19.0358	19.6194	20.0215	20.1707	20.1534	19.9015	19.1698	18.1809	17.3200	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9011	0.8671	0.8257	0.7550	0.6544	0.5134	0.3774	0.4093	0.5897	0.7686	0.8668	0.9093	(94)
Useful gains	651.8523	729.3032	751.2933	736.6808	658.0282	504.9022	356.9653	369.6877	511.3867	607.9834	624.5321	627.4804	(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													
	1425.3016	1401.9139	1284.8187	1089.7352	850.0254	577.4228	380.2935	399.1783	619.7490	919.8397	1193.3559	1417.9109	(97)
Space heating kWh													
	575.4463	451.9944	396.9429	254.1992	142.8459	0.0000	0.0000	0.0000	0.0000	232.0211	409.5532	588.0803	(98a)
Space heating requirement - total per year (kWh/year)												3051.0834	
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													
	575.4463	451.9944	396.9429	254.1992	142.8459	0.0000	0.0000	0.0000	0.0000	232.0211	409.5532	588.0803	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3051.0834	
Space heating per m2											(98c) / (4) =	34.2934	(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													
	575.4463	451.9944	396.9429	254.1992	142.8459	0.0000	0.0000	0.0000	0.0000	232.0211	409.5532	588.0803	(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)													
	623.4522	489.7014	430.0574	275.4054	154.7627	0.0000	0.0000	0.0000	0.0000	251.3771	443.7196	637.1401	(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													
	235.2424	207.9412	220.9491	194.6798	188.9243	170.4884	168.5839	175.2308	177.0705	197.1144	209.1319	232.7577	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9860	85.7526	85.3576	84.6590	83.4412	79.8000	79.8000	79.8000	79.8000	84.4264	85.5390	86.0481	(217)
Fuel for water heating, kWh/month													
	273.5823	242.4896	258.8511	229.9576	226.4161	213.6447	211.2580	219.5875	221.8929	233.4749	244.4872	270.4971	(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	25.3979	20.3751	18.3455	13.4407	10.3820	8.4822	9.4708	12.3105	15.9901	20.9799	23.6968	26.1038	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.7697	-15.1203	-23.8294	-29.4563	-34.1875	-32.8104	-32.4083	-29.3640	-24.4817	-18.3901	-11.2063	-8.2968	(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	(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	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.0730	-4.5424	-9.3838	-14.6408	-19.9171	-20.2265	-19.9941	-16.6721	-11.8875	-6.6725	-2.8215	-1.6264 (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	(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	3305.6158	(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	2846.1389	(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)	204.9754	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-399.7787	(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	6042.9515	(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	3305.6158	0.2100	694.1793	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2846.1389	0.2100	597.6892	(264)
Space and water heating			1291.8685	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.9754	0.1443	29.5843	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-269.3210	0.1327	-35.7383	
PV Unit electricity exported	-130.4576	0.1248	-16.2805	
Total			-52.0188	(269)
Total CO2, kg/year			1281.3632	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.4000	(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	3305.6158	1.1300	3735.3458	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2846.1389	1.1300	3216.1370	(278)
Space and water heating			6951.4828	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.9754	1.5338	314.3982	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-269.3210	1.4903	-401.3745	
PV Unit electricity exported	-130.4576	0.4580	-59.7534	
Total			-461.1279	(283)
Total Primary energy kWh/year			6934.8539	(286)
Target Primary Energy Rate (TPER)			77.9500	(287)