Full SAP Calculation Printout

Property Reference	1.F Flat - 10-12 MS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	75 C	DER	6.00	TER	16.66
Environmental	96 A	% DER < TER			63.99
CO_2 Emissions (t/year)	0.27	DFEE	86.40	TFEE	43.84
Compliance Check	See BREL	% DFEE < TFEE			-97.08
% DPER < TPER	29.15	DPER	62.95	TPER	88.85

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 3.1100	(2b) =	161.7200	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	161.7200	(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		10.0000	(17)
Infiltration rate		0.5000	(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) =	0.3875	(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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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 = 1.50)			15.1200	1.4151	21.3962			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
1F			52.0000	0.2500	13.0000			(28b)

External Wall 1	58.5900	17.0100	41.5800	0.3000	12.4740	(29a)
Total net area of external elements Aum(A, m2)			110.5900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5402	(33)
Party Wall 1			38.5300	0.0000	0.0000	(32)
Party Ceiling 1			52.0000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		22.1180 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	74.6582 (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	30.4762	29.9592	29.4422	26.8572	26.3402	23.7553	23.7553	23.2383	24.7892	26.3402	27.3742	28.4082	(38)
Heat transfer coeff	105.1345	104.6175	104.1005	101.5155	100.9985	98.4135	98.4135	97.8965	99.4475	100.9985	102.0325	103.0665	(39)

Average = Sum(39)m / 12 = 101.3862

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0218	2.0119	2.0019	1.9522	1.9423	1.8926	1.8926	1.8826	1.9125	1.9423	1.9622	1.9820	(40)
HLP (average)												1.9497	
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 1.7491 (42)

Hot water usage for mixer showers

53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405	(42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)

Average daily hot water use (litres/day) 100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)

Energy content (annual) Total = Sum(45)m = 1667.8640

Distribution loss (46)m = 0.15 x (45)m												
25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)

Water storage loss:

Store volume 172.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)

Temperature factor from Table 2b 0.7800 (49)

Enter (49) or (54) in (55) 1.2714 (55)

Total storage loss

39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)

If cylinder contains dedicated solar storage

39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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

235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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

235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)

Total per year (kWh/year) = Sum(64)m = 2405.8210 (64)

12Total per year (kWh/year) 2406 (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

107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(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	
Northeast	11.7600	11.2829	0.6200	0.7000	0.7700	39.9073	(75)
Southwest	3.3600	36.7938	0.6200	0.7000	0.7700	37.1824	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.0897	144.5679	233.0134	347.7309	443.3548	463.8430	437.3336	362.3715	272.1686	169.2716	94.7497	64.4107	(83)
Total gains	500.3441	575.6468	648.0267	748.3991	825.5902	833.1817	794.0719	720.2642	639.8178	548.8269	495.6528	479.8627	(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	34.3475	34.5173	34.6887	35.5720	35.7541	36.6933	36.6933	36.8870	36.3117	35.7541	35.3918	35.0367	
alpha	3.2898	3.3012	3.3126	3.3715	3.3836	3.4462	3.4462	3.4591	3.4208	3.3836	3.3595	3.3358	
util living area	0.9884	0.9808	0.9644	0.9170	0.8189	0.6571	0.5124	0.5726	0.8001	0.9436	0.9808	0.9900	(86)
MIT	18.7564	19.0049	19.4216	20.0250	20.5258	20.8505	20.9526	20.9310	20.6845	20.0407	19.3261	18.7507	(87)
Th 2	19.3188	19.3254	19.3320	19.3654	19.3721	19.4059	19.4059	19.4127	19.3923	19.3721	19.3587	19.3453	(88)
util rest of house	0.9843	0.9739	0.9509	0.8843	0.7468	0.5297	0.3417	0.3983	0.6932	0.9142	0.9726	0.9864	(89)
MIT 2	16.8386	17.1568	17.6842	18.4408	19.0061	19.3323	19.3948	19.3939	19.2000	18.4839	17.5872	16.8469	(90)
Living area fraction									fLA = Living area / (4) =			0.4683	(91)
MIT	17.7366	18.0222	18.4978	19.1826	19.7178	20.0432	20.1243	20.1137	19.8952	19.2129	18.4015	17.7384	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7366	18.0222	18.4978	19.1826	19.7178	20.0432	20.1243	20.1137	19.8952	19.2129	18.4015	17.7384	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9785	0.9662	0.9418	0.8797	0.7644	0.5847	0.4222	0.4801	0.7318	0.9104	0.9657	0.9812	(94)
Useful gains	489.5914	556.2147	610.3263	658.3901	631.0478	487.1311	335.2962	345.7970	468.2079	499.6664	478.6561	470.8263	(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	1412.6522	1372.8082	1248.9740	1043.8426	809.7826	535.6844	346.8342	363.5553	576.3159	869.8892	1153.1179	1395.3509	(97)
Space heating kWh	686.7572	548.7508	475.1539	277.5258	132.9787	0.0000	0.0000	0.0000	0.0000	275.4458	485.6124	687.8463	(98a)
Space heating requirement - total per year (kWh/year)												3570.0709	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	686.7572	548.7508	475.1539	277.5258	132.9787	0.0000	0.0000	0.0000	0.0000	275.4458	485.6124	687.8463	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3570.0709	
Space heating per m2											(98c) / (4) =	68.6552	(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	925.0867	728.2597	744.0132	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7772	0.8444	0.8033	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	718.9525	614.9123	597.7027	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	930.0842	886.1975	800.7590	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	152.0149	201.8362	151.0739	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.0037	50.4591	37.7685	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												126.2313	(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 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	1.0000	(306)

Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
	686.7572	548.7508	475.1539	277.5258	132.9787	0.0000	0.0000	0.0000	0.0000	275.4458	485.6124	687.8463 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	686.7572	548.7508	475.1539	277.5258	132.9787	0.0000	0.0000	0.0000	0.0000	275.4458	485.6124	687.8463
Space heating requirement												
	686.7572	548.7508	475.1539	277.5258	132.9787	0.0000	0.0000	0.0000	0.0000	275.4458	485.6124	687.8463 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												4.3000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	8.8381	11.7347	8.7834	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	17.6617	15.9525	17.6617	17.0920	17.6617	17.0920	17.6617	17.6617	17.0920	17.6617	17.0920	17.6617 (331)
Lighting	14.1242	11.3310	10.2023	7.4746	5.7736	4.7171	5.2669	6.8461	8.8924	11.6673	13.1782	14.5168 (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												3570.0709 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												35.7007 (313)
Space cooling fuel												29.3561 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)												
mechanical ventilation fans (SFP = 1.0540)												207.9525 (330a)
Total electricity for the above, kWh/year												207.9525 (331)
Electricity for lighting (calculated in Appendix L)												113.9905 (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												6327.1910 (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			350.0000	(367)
Space and Water heating from Heat pump	1707.3977	0.1548	157.8819	(367)
Electrical energy for heat distribution (space & water)	35.7007	0.0000	8.9108	(372)
Overall CO2 factor for heat network			0.0441	(386)
Total CO2 associated with community systems			263.5061	(373)
Space and water heating			263.5061	(376)
Space cooling	29.3561	0.1140	3.3469	(377)
Pumps, fans and electric keep-hot	207.9525	0.1387	28.8456	(378)
Energy for lighting	113.9905	0.1443	16.4523	(379)
Total CO2, kg/year			312.1508	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.0000	(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			350.0000	(467a)
Space and Water heating from Heat pump	1707.3977	1.5731	1604.5429	(467)
Electrical energy for heat distribution (space & water)	35.7007	0.0000	92.7334	(472)
Overall CO2 factor for heat network			0.4589	(486)
Total CO2 associated with community systems			2742.2579	(473)
Space and water heating			2742.2579	(476)
Space cooling	29.3561	1.4202	41.6924	(477)
Pumps, fans and electric keep-hot	207.9525	1.5128	314.5906	(478)
Energy for lighting	113.9905	1.5338	174.8424	(479)
Total Primary energy kWh/year			3273.3833	(483)

Dwelling Primary energy Rate (DPER) 62.9500 (484)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	3.1100 (2b)	=	161.7200 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	161.7200 (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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1237	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3737	(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) =	0.2896	(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	0.3692	0.3620	0.3548	0.3186	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
1F			52.0000	0.1300	6.7600			(28b)
External Wall 1	58.5900	13.0000	45.5900	0.1800	8.2062			(29a)
Total net area of external elements Aum(A, m2)			110.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5776			(33)
Party Wall 1			38.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	5.5295	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	35.1071	(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	30.3217	30.1804	30.0420	29.3916	29.2699	28.7034	28.7034	28.5985	28.9216	29.2699	29.5161	29.7734	(38)
Heat transfer coeff	65.4288	65.2875	65.1490	64.4987	64.3770	63.8105	63.8105	63.7056	64.0287	64.3770	64.6231	64.8805	(39)
Average = Sum(39)m / 12 =												64.4981	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2582	1.2555	1.2529	1.2404	1.2380	1.2271	1.2271	1.2251	1.2313	1.2380	1.2428	1.2477	(40)
HLP (average)												1.2403	
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 1.7491 (42)

Hot water usage for mixer showers

53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)

Average daily hot water use (litres/day) 100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)

Energy content (annual) Total = Sum(45)m = 1667.8640

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

25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)

Water storage loss:

Store volume 172.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5107 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8158 (55)

Total storage loss

25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)

If cylinder contains dedicated solar storage

25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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

221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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													
197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)

Total per year (kWh/year) = Sum(64)m = 2012.0777 (64)

12Total per year (kWh/year) 2012 (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

96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)

-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)

Water heating gains (Table 5)

129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)

Total internal gains

411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917	(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	
Northeast	8.6400	11.2829	0.6300	0.7000	0.7700	29.7926	(75)
Southwest	2.4700	36.7938	0.6300	0.7000	0.7700	27.7743	(79)

Solar gains	57.5669	107.9536	173.9921	259.6427	331.0357	346.3307	326.5384	270.5718	203.2263	126.3989	70.7540	48.0992	(83)
Total gains	468.7610	526.9858	576.9451	648.2548	701.2108	700.6133	668.2164	613.4041	555.8194	493.8939	459.6010	451.4908	(84)

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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	55.1915	55.3109	55.4285	55.9874	56.0932	56.5912	56.5912	56.6843	56.3983	56.0932	55.8795	55.6579	
alpha	4.6794	4.6874	4.6952	4.7325	4.7395	4.7727	4.7727	4.7790	4.7599	4.7395	4.7253	4.7105	
util living area	0.9890	0.9800	0.9591	0.8925	0.7548	0.5635	0.4163	0.4703	0.7203	0.9249	0.9790	0.9907	(86)
MIT	19.7283	19.9186	20.2081	20.5906	20.8592	20.9724	20.9947	20.9908	20.9158	20.5684	20.0911	19.6983	(87)
Th 2	19.8737	19.8758	19.8779	19.8878	19.8897	19.8984	19.8984	19.9000	19.8950	19.8897	19.8860	19.8820	(88)
util rest of house	0.9856	0.9738	0.9461	0.8602	0.6919	0.4747	0.3141	0.3617	0.6316	0.8945	0.9712	0.9878	(89)
MIT 2	18.4288	18.6701	19.0322	19.4947	19.7803	19.8841	19.8968	19.8970	19.8430	19.4829	18.8977	18.3967	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	19.0373	19.2547	19.5829	20.0079	20.2855	20.3937	20.4109	20.4092	20.3454	19.9912	19.4566	19.0062	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0373	19.2547	19.5829	20.0079	20.2855	20.3937	20.4109	20.4092	20.3454	19.9912	19.4566	19.0062	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9821	0.9694	0.9420	0.8641	0.7157	0.5156	0.3621	0.4127	0.6699	0.8978	0.9674	0.9847	(94)
Useful gains	460.3797	510.8514	543.4839	560.1765	501.8370	361.2271	241.9314	253.1287	372.3469	443.3949	444.6268	444.5698	(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	964.2453	937.1836	852.3371	716.4445	552.7078	369.6996	243.1774	255.4073	399.8830	604.5763	798.5204	960.6334	(97)
Space heating kWh	374.8761	286.4952	229.7868	112.5129	37.8479	0.0000	0.0000	0.0000	0.0000	119.9189	254.8034	383.9513	(98a)
Space heating requirement - total per year (kWh/year)												1800.1925	
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	374.8761	286.4952	229.7868	112.5129	37.8479	0.0000	0.0000	0.0000	0.0000	119.9189	254.8034	383.9513	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1800.1925	
Space heating per m2										(98c) / (4) =		34.6191	(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	374.8761	286.4952	229.7868	112.5129	37.8479	0.0000	0.0000	0.0000	0.0000	119.9189	254.8034	383.9513	(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)	406.1496	310.3957	248.9564	121.8991	41.0053	0.0000	0.0000	0.0000	0.0000	129.9230	276.0600	415.9819	(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	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4782	85.1650	84.5371	83.2227	81.3728	79.8000	79.8000	79.8000	79.8000	83.3291	84.8869	85.5489	(217)
Fuel for water heating, kWh/month	230.5602	204.8217	219.8172	197.9768	197.3795	182.6008	181.2006	187.7579	189.0926	200.4817	207.4978	228.0827	(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	16.0007	12.8364	11.5577	8.4677	6.5407	5.3438	5.9666	7.7557	10.0738	13.2174	14.9290	16.4454	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.0683	-20.9172	-31.6975	-37.6496	-42.3904	-40.2476	-39.7772	-36.6675	-31.4861	-24.8082	-15.8531	-12.0411	(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	-4.9663	-10.6863	-21.6856	-33.2268	-44.5711	-44.9977	-44.4484	-37.3257	-26.9695	-15.4746	-6.6935	-3.9083	(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												1950.3711	(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		2427.2696 (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)		129.1350 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-642.5576 (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		3950.2180 (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	1950.3711	0.2100	409.5779	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2427.2696	0.2100	509.7266	(264)
Space and water heating			919.3045	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.1350	0.1443	18.6382	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	0.1335	-46.3925	
PV Unit electricity exported	-294.9537	0.1253	-36.9657	
Total			-83.3582	(269)
Total CO2, kg/year			866.5137	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.6600	(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	1950.3711	1.1300	2203.9193	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2427.2696	1.1300	2742.8146	(278)
Space and water heating			4946.7339	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.1350	1.5338	198.0716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	1.4932	-519.0405	
PV Unit electricity exported	-294.9537	0.4600	-135.6819	
Total			-654.7223	(283)
Total Primary energy kWh/year			4620.1839	(286)
Target Primary Energy Rate (TPER)			88.8500	(287)

Full SAP Calculation Printout

Property Reference	Flat 401 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 401 VL - Be Green	Prop Type Ref	Flat 203 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	3.78	TER	16.52
Environmental	97 A	% DER < TER			77.12
CO_2 Emissions (t/year)	0.17	DFEE	43.84	TFEE	39.52
Compliance Check	See BREL	% DFEE < TFEE			-10.94
% DPER < TPER	54.70	DPER	40.13	TPER	88.57

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.7700	(2b) =	138.5000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.5000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1444	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2944	(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) =	0.2282	(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	0.2909	0.2852	0.2795	0.2510	0.2453	0.2168	0.2168	0.2111	0.2282	0.2453	0.2567	0.2681	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5423	0.5407	0.5391	0.5315	0.5301	0.5235	0.5235	0.5223	0.5260	0.5301	0.5329	0.5359	(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	
Glazed Door (Uw = 0.95)			11.5800	0.9152	10.5983			(27)
Window (Uw = 0.95)			11.2800	0.9152	10.3237			(27)
Door			1.8900	0.8000	1.5120			(26)
External Wall 1	69.6900	24.7500	44.9400	0.1500	6.7410	14.0000	629.1600	(29a)
Total net area of external elements Aum(A, m2)			69.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.1750			(33)

Party Wall 1	14.6800	0.0000	0.0000	20.0000	293.6000 (32)
Party Floor 1	50.0000			40.0000	2000.0000 (32d)
Party Ceiling 1	50.0000			40.0000	2000.0000 (32b)
Internal Wall 1	53.7400			9.0000	483.6600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5406.4201 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 108.1284 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	50.3200	0.0700	3.5224
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
E16 Corner (normal)	8.3100	0.0900	0.7479
E17 Corner (inverted – internal area greater than external area)	2.7700	-0.0900	-0.2493
E18 Party wall between dwellings	5.5400	0.0600	0.3324
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.6000	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	10.5000	0.0500	0.5250
E3 Sill	9.6000	0.0500	0.4800
E4 Jamb	27.8000	0.0500	1.3900

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4906 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6655 (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	24.7865	24.7114	24.6377	24.2920	24.2273	23.9262	23.9262	23.8704	24.0422	24.2273	24.3582	24.4950	(38)
Heat transfer coeff	63.4520	63.3769	63.3033	62.9575	62.8928	62.5917	62.5917	62.5359	62.7077	62.8928	63.0237	63.1605	(39)

Average = Sum(39)m / 12 = 62.9572

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2690	1.2675	1.2661	1.2592	1.2579	1.2518	1.2518	1.2507	1.2542	1.2579	1.2605	1.2632	(40)
HLP (average)												1.2591	
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 1.6901 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)

Energy content (annual) Total = Sum(45)m = 832.1197
Distribution loss (46)m = 0.15 x (45)m

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

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)

Total per year (kWh/year) = Sum(64)m = 707.3017 (64)
12Total per year (kWh/year) 707 (64)
Electric shower(s)

42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)
Heat gains from water heating, kWh/month

28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)												
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542 (72)
Total internal gains												
	308.7177	317.2236	303.9058	295.3692	280.6905	271.5357	261.6280	261.2424	268.8523	276.6680	292.2114	301.9060 (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
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)
Northwest	9.6000	11.2829	0.4700	0.7000	0.7700	24.6958 (81)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)

Solar gains	70.3233	137.6280	235.6986	371.4747	488.5852	516.9434	485.1169	392.8716	281.9482	164.8858	87.4802	58.0797 (83)
Total gains	379.0410	454.8515	539.6044	666.8439	769.2757	788.4791	746.7449	654.1140	550.8005	441.5538	379.6916	359.9857 (84)

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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	23.6680	23.6961	23.7236	23.8539	23.8784	23.9933	23.9933	24.0147	23.9489	23.8784	23.8289	23.7772	
alpha	2.5779	2.5797	2.5816	2.5903	2.5919	2.5996	2.5996	2.6010	2.5966	2.5919	2.5886	2.5851	
util living area	0.9535	0.9270	0.8771	0.7676	0.6173	0.4609	0.3509	0.4091	0.6304	0.8448	0.9315	0.9587	(86)
MIT	18.3877	18.7590	19.3350	20.0621	20.5869	20.8603	20.9497	20.9245	20.6788	19.9448	19.0405	18.3165	(87)
Th 2	19.8652	19.8663	19.8675	19.8730	19.8740	19.8788	19.8788	19.8796	19.8769	19.8740	19.8719	19.8698	(88)
util rest of house	0.9461	0.9158	0.8583	0.7341	0.5663	0.3925	0.2678	0.3197	0.5603	0.8132	0.9190	0.9521	(89)
MIT 2	17.5118	17.8752	18.4330	19.1175	19.5795	19.8000	19.8591	19.8478	19.6752	19.0322	18.1613	17.4449	(90)
Living area fraction									fLA = Living area / (4) =			0.6250	(91)
MIT	18.0592	18.4276	18.9968	19.7079	20.2091	20.4627	20.5407	20.5207	20.3025	19.6025	18.7108	17.9896	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0592	18.4276	18.9968	19.7079	20.2091	20.4627	20.5407	20.5207	20.3025	19.6025	18.7108	17.9896	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9306	0.8979	0.8413	0.7287	0.5822	0.4290	0.3177	0.3720	0.5884	0.8043	0.9027	0.9376	(94)
Useful gains	352.7503	408.4298	453.9548	485.9348	447.8681	338.2664	237.2047	243.3452	324.0756	355.1566	342.7570	337.5255	(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	873.0506	857.3349	791.0878	680.4370	535.1626	366.9566	246.6563	257.6944	388.9418	566.1956	731.7552	870.9600	(97)
Space heating kWh	387.1034	301.6642	250.8270	140.0416	64.9471	0.0000	0.0000	0.0000	0.0000	157.0130	280.0787	396.8753	(98a)
Space heating requirement - total per year (kWh/year)												1978.5502	
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	387.1034	301.6642	250.8270	140.0416	64.9471	0.0000	0.0000	0.0000	0.0000	157.0130	280.0787	396.8753	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1978.5502	
Space heating per m2											(98c) / (4) =	39.5710	(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	588.3621	463.1787	475.2732	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8523	0.8937	0.8585	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	501.4502	413.9552	408.0014	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	895.2480	847.9395	741.0874	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	283.5344	322.8843	247.8160	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	70.8836	80.7211	61.9540	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												213.5587	(107)
Energy for space heating												39.5710	(99)
Energy for space cooling												4.2712	(108)
Total												43.8422	(109)
Fabric Energy Efficiency (DFEE)												43.8	(109)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000 (1b)	x	2.7700 (2b)	=	138.5000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.5000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1444	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3944	(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) =	0.3057	(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	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603			(27)
External Wall 1	69.6900	12.5100	57.1800	0.1800	10.2924			(29a)
Total net area of external elements Aum(A, m2)			69.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3427			(33)
Party Wall 1			14.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				108.1284 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E7 Party floor between dwellings (in blocks of flats)	50.3200	0.0700	3.5224	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238	
E16 Corner (normal)	8.3100	0.0900	0.7479	
E17 Corner (inverted – internal area greater than external area)	2.7700	-0.0900	-0.2493	
E18 Party wall between dwellings	5.5400	0.0600	0.3324	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.6000	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	10.5000	0.0500	0.5250	
E3 Sill	9.6000	0.0500	0.4800	
E4 Jamb	27.8000	0.0500	1.3900	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.8722	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	31.2149	(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	26.3234	26.1886	26.0565	25.4360	25.3199	24.7794	24.7794	24.6794	24.9876	25.3199	25.5547	25.8003	(38)
Heat transfer coeff													
	57.5383	57.4035	57.2714	56.6509	56.5348	55.9943	55.9943	55.8943	56.2025	56.5348	56.7697	57.0152	(39)
Average = Sum(39)m / 12 =												56.6503	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1508	1.1481	1.1454	1.1330	1.1307	1.1199	1.1199	1.1179	1.1241	1.1307	1.1354	1.1403	(40)
HLP (average)												1.1330	
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												1.6901	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												50.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)
Energy content (annual)										Total = Sum(45)m =		832.1197	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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													
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)
										Total per year (kWh/year) = Sum(64)m =		707.3017	(64)
12Total per year (kWh/year)												707	(64)
Electric shower(s)													
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												478.7637	(64a)
Heat gains from water heating, kWh/month													
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.4107	82.3832	74.4107	76.8910	74.4107	76.8910	74.4107	74.4107	76.8910	74.4107	76.8910	74.4107	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542	(72)
Total internal gains													
	308.8657	317.3875	304.0538	295.5222	280.8385	271.6887	261.7761	261.3905	269.0053	276.8160	292.3644	302.0540	(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	
Northeast	5.2400	11.2829	0.6300	0.7000	0.7700	18.0686	(75)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
Northwest	4.4600	11.2829	0.6300	0.7000	0.7700	15.3790	(81)

Solar gains	43.7928	85.7052	146.7757	231.3256	304.2518	321.9107	302.0918	244.6495	175.5761	102.6792	54.4769	36.1683	(83)
Total gains	352.6585	403.0927	450.8296	526.8478	585.0903	593.5993	563.8679	506.0400	444.5814	379.4952	346.8413	338.2223	(84)

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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	26.1006	26.1619	26.2222	26.5094	26.5639	26.8203	26.8203	26.8683	26.7209	26.5639	26.4540	26.3401	
alpha	2.7400	2.7441	2.7481	2.7673	2.7709	2.7880	2.7880	2.7912	2.7814	2.7709	2.7636	2.7560	
util living area	0.9584	0.9394	0.9051	0.8224	0.6944	0.5350	0.4114	0.4672	0.6835	0.8696	0.9395	0.9625	(86)
MIT	18.5786	18.8775	19.3551	20.0139	20.5324	20.8397	20.9434	20.9187	20.6708	19.9905	19.1900	18.5335	(87)
Th 2	19.9596	19.9618	19.9639	19.9740	19.9758	19.9846	19.9846	19.9863	19.9812	19.9758	19.9720	19.9681	(88)
util rest of house	0.9520	0.9302	0.8903	0.7950	0.6483	0.4670	0.3253	0.3775	0.6194	0.8429	0.9287	0.9567	(89)
MIT 2	17.7621	18.0567	18.5241	19.1586	19.6293	19.8891	19.9606	19.9493	19.7649	19.1533	18.3754	17.7234	(90)
Living area fraction									fLA = Living area / (4) =			0.6250	(91)
MIT	18.2724	18.5697	19.0435	19.6931	20.1937	20.4833	20.5748	20.5551	20.3311	19.6766	18.8845	18.2297	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2724	18.5697	19.0435	19.6931	20.1937	20.4833	20.5748	20.5551	20.3311	19.6766	18.8845	18.2297	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9385	0.9148	0.8746	0.7866	0.6587	0.5014	0.3763	0.4292	0.6428	0.8339	0.9144	0.9440	(94)
Useful gains	330.9621	368.7460	394.3053	414.4140	385.3959	297.6204	212.1715	217.1688	285.7946	316.4448	317.1509	319.2691	(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	803.9482	784.6900	718.3833	611.4412	480.1919	329.4290	222.5681	232.2485	350.2033	513.1432	669.0032	799.9069	(97)
Space heating kWh	351.9017	279.5143	241.1140	141.8596	70.5282	0.0000	0.0000	0.0000	0.0000	146.3436	253.3336	357.5946	(98a)
Space heating requirement - total per year (kWh/year)												1842.1897	
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	351.9017	279.5143	241.1140	141.8596	70.5282	0.0000	0.0000	0.0000	0.0000	146.3436	253.3336	357.5946	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1842.1897	
Space heating per m2											(98c) / (4) =	36.8438	(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	526.3468	414.3581	424.7964	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8162	0.8678	0.8321	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	429.5849	359.5670	353.4620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	667.3006	634.0281	567.8590	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	171.1553	204.1990	159.5113	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.7888	51.0498	39.8778	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												133.7164	(107)
Energy for space heating												36.8438	(99)
Energy for space cooling												2.6743	(108)
Total												39.5181	(109)
Fabric Energy Efficiency (TFEE)												39.5	(109)

Full SAP Calculation Printout

Property Reference	Flat 401 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 401 WCS - Green	Prop Type Ref	Flat 102 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	85 B	DER	2.74	TER	12.59
Environmental	97 A	% DER < TER			78.24
CO_2 Emissions (t/year)	0.34	DFEE	43.75	TFEE	46.87
Compliance Check	See BREL	% DFEE < TFEE			6.65
% DPER < TPER	56.72	DPER	28.85	TPER	66.66

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		61.0000 (1b)	x	2.5300 (2b)	=	154.3300 (1b)	-
First floor		77.0000 (1c)	x	3.1000 (2c)	=	238.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.0300	(5)

2. Ventilation rate

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		4 * 10	=	40.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5)	=	0.1018 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2518 (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)	=	0.1951 (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	0.2488	0.2439	0.2390	0.2146	0.2098	0.1854	0.1854	0.1805	0.1951	0.2098	0.2195	0.2293	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5309	0.5297	0.5286	0.5230	0.5220	0.5172	0.5172	0.5163	0.5190	0.5220	0.5241	0.5263	(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 = 0.95)			33.4100	0.9152	30.5776			(27)
Glazed Doors (Uw = 0.95)			2.1100	0.9152	1.9311			(27)
Solid Door			2.0000	0.8000	1.6000			(26)
Heatloss Floor 1			16.0400	0.1000	1.6040	30.0000	481.2000	(28b)
External Wall 1	188.1100	37.5200	150.5900	0.1500	22.5885	14.0000	2108.2600	(29a)

External Roof 1	77.0000	77.0000	0.1000	7.7000	9.0000	693.0000 (30)
Total net area of external elements Aum(A, m2)		281.1500				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	66.0012			(33)
Party Wall 1		10.0400	0.0000	0.0000	20.0000	200.8000 (32)
Party Floor 1		61.0000			40.0000	2440.0000 (32d)
Internal Wall 1		229.6900			9.0000	2067.2100 (32c)
Internal Floor 1		61.0000			30.0000	1830.0000 (32d)
Internal Ceiling 1		61.0000			30.0000	1830.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11650.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 84.4237 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	25.0500	0.0900	2.2545
E17 Corner (inverted – internal area greater than external area)	5.0600	-0.0900	-0.4554
E7 Party floor between dwellings (in blocks of flats)	34.5900	0.0700	2.4213
E18 Party wall between dwellings	2.5300	0.0600	0.1518
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.4430	2.9858
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.9700	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	18.0900	0.0500	0.9045
E3 Sill	17.1400	0.0500	0.8570
E4 Jamb	57.9000	0.0500	2.8950
E6 Intermediate floor within a dwelling	34.9000	0.0000	0.0000
E15 Flat roof with parapet	34.9000	0.5600	19.5440
E20 Exposed floor (normal)	11.4600	0.1250	1.4325
E21 Exposed floor (inverted)	11.1400	0.3200	3.5648

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 36.5558 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 102.5570 (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	68.8637	68.7079	68.5551	67.8375	67.7033	67.0783	67.0783	66.9625	67.3190	67.7033	67.9749	68.2588	(38)
Heat transfer coeff	171.4207	171.2649	171.1121	170.3945	170.2603	169.6353	169.6353	169.5195	169.8760	170.2603	170.5319	170.8158	(39)
Average = Sum(39)m / 12 =												170.3939	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2422	1.2410	1.2399	1.2347	1.2338	1.2292	1.2292	1.2284	1.2310	1.2338	1.2357	1.2378	(40)
HLP (average)												1.2347	
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 2.9132 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.5432	31.0748	30.4151	29.1987	28.2879	27.2780	26.7325	27.3876	28.1009	29.1815	30.4229	31.4366	(42b)

Hot water usage for other uses

44.4639	42.8470	41.2301	39.6133	37.9964	36.3795	36.3795	37.9964	39.6133	41.2301	42.8470	44.4639	(42c)

Average daily hot water use (litres/day) 69.6673 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.0071	73.9218	71.6452	68.8120	66.2843	63.6575	63.1120	65.3840	67.7141	70.4116	73.2699	75.9005	(44)
Energy conte	120.3767	105.2636	110.1160	94.2002	89.2315	78.2744	76.3285	80.9590	83.4983	95.5479	104.3864	118.8418	(45)
Energy content (annual)										Total = Sum(45)m =		1157.0243	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	102.3202	89.4741	93.5986	80.0702	75.8467	66.5332	64.8793	68.8152	70.9735	81.2157	88.7284	101.0155	(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													
	102.3202	89.4741	93.5986	80.0702	75.8467	66.5332	64.8793	68.8152	70.9735	81.2157	88.7284	101.0155	(64)
									Total per year (kWh/year) = Sum(64)m =			983.4707	(64)
12Total per year (kWh/year)												983	(64)
Electric shower(s)													
	58.5123	52.1349	56.9294	54.3270	55.3464	52.7951	54.5549	55.3464	54.3270	56.9294	55.8589	58.5123	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						665.5740	(64a)
Heat gains from water heating, kWh/month													
	40.2081	35.4023	37.6320	33.5993	32.7983	29.8321	29.8586	31.0404	31.3251	34.5363	36.1468	39.8820	(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	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	154.9100	171.5075	154.9100	160.0737	154.9100	160.0737	154.9100	154.9100	160.0737	154.9100	160.0737	154.9100 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	307.1264	310.3134	302.2822	285.1848	263.6024	243.3180	229.7668	226.5798	234.6110	251.7084	273.2907	293.5752 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659 (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)

	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271 (71)

Water heating gains (Table 5)

	54.0432	52.6819	50.5806	46.6657	44.0837	41.4334	40.1325	41.7210	43.5071	46.4197	50.2039	53.6048 (72)

Total internal gains

	582.7772	601.2005	574.4705	558.6218	529.2938	511.5228	491.5069	489.9084	504.8894	519.7357	550.2660	568.7876 (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
Northeast	2.4400	11.2829	0.4700	0.7000	0.7700	6.2768 (75)
Southwest	17.4100	36.7938	0.4700	0.7000	0.7700	146.0505 (79)
Northwest	13.5600	11.2829	0.4700	0.7000	0.7700	34.8828 (81)
Southwest	2.1100	36.7938	0.4700	0.7000	0.7700	17.7005 (79)

Solar gains	204.9106	362.7102	532.5900	720.7729	862.8832	881.0812	839.2863	729.5295	597.1701	410.6632	247.9254	173.7498 (83)
Total gains	787.6879	963.9107	1107.0606	1279.3947	1392.1770	1392.6040	1330.7933	1219.4380	1102.0595	930.3990	798.1914	742.5374 (84)

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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	18.8789	18.8961	18.9130	18.9926	19.0076	19.0776	19.0776	19.0907	19.0506	19.0076	18.9773	18.9458	
alpha	2.2586	2.2597	2.2609	2.2662	2.2672	2.2718	2.2718	2.2727	2.2700	2.2672	2.2652	2.2631	
util living area													
	0.9601	0.9375	0.9037	0.8370	0.7372	0.6044	0.4829	0.5309	0.7153	0.8743	0.9420	0.9648	(86)
MIT	17.6824	18.0792	18.6661	19.4351	20.1199	20.6140	20.8358	20.7904	20.3930	19.4877	18.4448	17.6031	(87)
Th 2	19.8864	19.8873	19.8882	19.8923	19.8931	19.8967	19.8967	19.8973	19.8953	19.8931	19.8915	19.8899	(88)
util rest of house													
	0.9545	0.9288	0.8899	0.8124	0.6946	0.5341	0.3841	0.4326	0.6542	0.8499	0.9324	0.9598	(89)
MIT 2	16.8624	17.2536	17.8300	18.5756	19.2170	19.6519	19.8206	19.7939	19.4785	18.6426	17.6227	16.7863	(90)
Living area fraction										fLA = Living area / (4) =		0.1300	(91)
MIT	16.9690	17.3609	17.9387	18.6874	19.3344	19.7770	19.9526	19.9235	19.5974	18.7525	17.7296	16.8925	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9690	17.3609	17.9387	18.6874	19.3344	19.7770	19.9526	19.9235	19.5974	18.7525	17.7296	16.8925	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9330	0.9016	0.8581	0.7795	0.6698	0.5257	0.3895	0.4352	0.6350	0.8175	0.9063	0.9400	(94)
Useful gains	734.9485	869.0916	949.9694	997.3498	932.4643	732.0582	518.3980	530.6749	699.8245	760.5892	723.3648	697.9859	(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													
	2171.7357	2134.1212	1957.3051	1667.7143	1299.8332	878.1953	568.7209	597.2997	933.8782	1388.0451	1812.6867	2168.0747	(97)
Space heating kWh													
	1068.9696	850.0999	749.4578	482.6625	273.3225	0.0000	0.0000	0.0000	0.0000	466.8272	784.3118	1093.7461	(98a)
Space heating requirement - total per year (kWh/year)												5769.3974	
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													
	1068.9696	850.0999	749.4578	482.6625	273.3225	0.0000	0.0000	0.0000	0.0000	466.8272	784.3118	1093.7461	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5769.3974	
Space heating per m2											(98c) / (4) =	41.8072	(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	1594.5716	1255.3010	1288.3485	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6871	0.7519	0.7143	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1095.6065	943.8562	920.2972	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1561.6397	1492.3534	1365.2893	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.5439	408.0820	331.0741	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

Intermittency factor (Table 10b)

	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	83.8860	102.0205	82.7685	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling requirement 268.6750 (107)
Energy for space heating 41.8072 (99)
Energy for space cooling 1.9469 (108)
Total 43.7541 (109)
Fabric Energy Efficiency (DFEE) 43.8 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	61.0000 (1b)	x	2.5300 (2b)	=	154.3300 (1b)	-
First floor	77.0000 (1c)	x	3.1000 (2c)	=	238.7000 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 138.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	393.0300	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1018	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3518	(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) =	0.2726	(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													
	0.3476	0.3408	0.3340	0.2999	0.2931	0.2590	0.2590	0.2522	0.2726	0.2931	0.3067	0.3203	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5604	0.5581	0.5558	0.5450	0.5429	0.5335	0.5335	0.5318	0.5372	0.5429	0.5470	0.5513	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			32.5000	1.1450	37.2137			(27)
Heatloss Floor 1			16.0400	0.1300	2.0852			(28b)
External Wall 1	188.1100	34.5000	153.6100	0.1800	27.6498			(29a)
External Roof 1	77.0000		77.0000	0.1100	8.4700			(30)
Total net area of external elements Aum(A, m2)			281.1500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4187			(33)
Party Wall 1			10.0400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 84.4237 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	25.0500	0.0900	2.2545
E17 Corner (inverted – internal area greater than external area)	5.0600	-0.0900	-0.4554

E7 Party floor between dwellings (in blocks of flats)	34.5900	0.0700	2.4213	
E18 Party wall between dwellings	2.5300	0.0600	0.1518	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.0200	0.1348	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.9700	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	18.0900	0.0500	0.9045	
E3 Sill	17.1400	0.0500	0.8570	
E4 Jamb	57.9000	0.0500	2.8950	
E6 Intermediate floor within a dwelling	34.9000	0.0000	0.0000	
E15 Flat roof with parapet	34.9000	0.5600	19.5440	
E20 Exposed floor (normal)	11.4600	0.3200	3.6672	
E21 Exposed floor (inverted)	11.1400	0.3200	3.5648	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 35.9395 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 113.3582 (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	72.6853	72.3811	72.0828	70.6820	70.4200	69.1999	69.1999	68.9740	69.6699	70.4200	70.9501	71.5044	(38)
Heat transfer coeff	186.0436	185.7393	185.4411	184.0403	183.7782	182.5582	182.5582	182.3322	183.0281	183.7782	184.3084	184.8627	(39)

Average = Sum(39)m / 12 = 184.0390

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3481	1.3459	1.3438	1.3336	1.3317	1.3229	1.3229	1.3212	1.3263	1.3317	1.3356	1.3396	(40)
HLP (average)												1.3336	
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 2.9132 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.5432	31.0748	30.4151	29.1987	28.2879	27.2780	26.7325	27.3876	28.1009	29.1815	30.4229	31.4366	(42b)
Hot water usage for other uses	44.4639	42.8470	41.2301	39.6133	37.9964	36.3795	36.3795	37.9964	39.6133	41.2301	42.8470	44.4639	(42c)

Average daily hot water use (litres/day) 69.6673 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.0071	73.9218	71.6452	68.8120	66.2843	63.6575	63.1120	65.3840	67.7141	70.4116	73.2699	75.9005	(44)
Energy conte	120.3767	105.2636	110.1160	94.2002	89.2315	78.2744	76.3285	80.9590	83.4983	95.5479	104.3864	118.8418	(45)
Energy content (annual)										Total = Sum(45)m =		1157.0243	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.3202	89.4741	93.5986	80.0702	75.8467	66.5332	64.8793	68.8152	70.9735	81.2157	88.7284	101.0155	(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	102.3202	89.4741	93.5986	80.0702	75.8467	66.5332	64.8793	68.8152	70.9735	81.2157	88.7284	101.0155	(64)
									Total per year (kWh/year) = Sum(64)m =			983.4707	(64)
12Total per year (kWh/year)												983	(64)
Electric shower(s)	58.5123	52.1349	56.9294	54.3270	55.3464	52.7951	54.5549	55.3464	54.3270	56.9294	55.8589	58.5123	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			665.5740	(64a)
Heat gains from water heating, kWh/month	40.2081	35.4023	37.6320	33.5993	32.7983	29.8321	29.8586	31.0404	31.3251	34.5363	36.1468	39.8820	(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	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.9100	171.5075	154.9100	160.0737	154.9100	160.0737	154.9100	154.9100	160.0737	154.9100	160.0737	154.9100	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	307.1264	310.3134	302.2822	285.1848	263.6024	243.3180	229.7668	226.5798	234.6110	251.7084	273.2907	293.5752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	(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)	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	(71)
Water heating gains (Table 5)	54.0432	52.6819	50.5806	46.6657	44.0837	41.4334	40.1325	41.7210	43.5071	46.4197	50.2039	53.6048	(72)
Total internal gains	582.7772	601.2005	574.4705	558.6218	529.2938	511.5228	491.5069	489.9084	504.8894	519.7357	550.2660	568.7876	(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	
Northeast	2.2300	11.2829	0.6300	0.7000	0.7700	7.6895	(75)
Southwest	17.8600	36.7938	0.6300	0.7000	0.7700	200.8299	(79)
Northwest	12.4100	11.2829	0.6300	0.7000	0.7700	42.7923	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	251.3117	444.8448	653.1950	883.9943	1058.2880	1080.6078	1029.3479	894.7347	732.4000	503.6572	304.0671	213.0945	(83)
Total gains	834.0889	1046.0453	1227.6656	1442.6161	1587.5818	1592.1306	1520.8548	1384.6431	1237.2895	1023.3929	854.3331	781.8821	(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	17.3951	17.4236	17.4516	17.5844	17.6095	17.7272	17.7272	17.7491	17.6817	17.6095	17.5588	17.5062	
alpha	2.1597	2.1616	2.1634	2.1723	2.1740	2.1818	2.1818	2.1833	2.1788	2.1740	2.1706	2.1671	
util living area	0.9566	0.9303	0.8912	0.8166	0.7098	0.5751	0.4569	0.5055	0.6924	0.8614	0.9366	0.9619	(86)
MIT	17.5003	17.9402	18.5791	19.4020	20.1123	20.6135	20.8343	20.7876	20.3795	19.4302	18.3178	17.4218	(87)
Th 2	19.8033	19.8050	19.8067	19.8146	19.8161	19.8230	19.8230	19.8242	19.8203	19.8161	19.8131	19.8100	(88)
util rest of house	0.9503	0.9204	0.8753	0.7888	0.6633	0.5013	0.3555	0.4037	0.6266	0.8341	0.9259	0.9563	(89)
MIT 2	16.6330	17.0662	17.6921	18.4879	19.1476	19.5853	19.7499	19.7241	19.4053	18.5353	17.4500	16.5596	(90)
Living area fraction									fLA = Living area / (4) =			0.1300	(91)
MIT	16.7458	17.1798	17.8075	18.6068	19.2730	19.7190	19.8909	19.8624	19.5319	18.6516	17.5628	16.6717	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7458	17.1798	17.8075	18.6068	19.2730	19.7190	19.8909	19.8624	19.5319	18.6516	17.5628	16.6717	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9266	0.8903	0.8405	0.7543	0.6388	0.4941	0.3618	0.4073	0.6079	0.7994	0.8971	0.9344	(94)
Useful gains	772.8276	931.2656	1031.8285	1088.2280	1014.2058	786.6740	550.2428	563.9471	752.1651	818.1232	766.3929	730.6079	(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	2315.4551	2280.8391	2096.8659	1786.4382	1391.7533	934.5151	600.7767	631.3008	994.1975	1479.7152	1928.3888	2305.5481	(97)
Space heating kWh	1147.7149	906.9134	792.3879	502.7114	280.8954	0.0000	0.0000	0.0000	0.0000	492.2244	836.6370	1171.7555	(98a)
Space heating requirement - total per year (kWh/year)												6131.2398	
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	1147.7149	906.9134	792.3879	502.7114	280.8954	0.0000	0.0000	0.0000	0.0000	492.2244	836.6370	1171.7555	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6131.2398	
Space heating per m2											(98c) / (4) =	44.4293	(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	1716.0467	1350.9304	1385.7249	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7010	0.7628	0.7251	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1202.8906	1030.5140	1004.7862	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1794.8526	1714.5033	1558.3863	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	426.2126	508.8880	411.8785	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	106.5532	127.2220	102.9696	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												336.7448	(107)
Energy for space heating												44.4293	(99)
Energy for space cooling												2.4402	(108)
Total												46.8695	(109)
Fabric Energy Efficiency (TFEE)												46.9	(109)

Full SAP Calculation Printout

Property Reference	Flat 402 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 402 VL - Be Green	Prop Type Ref	Flat 402 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	3.69	TER	17.19
Environmental	97 A	% DER < TER			78.53
CO_2 Emissions (t/year)	0.18	DFEE	40.96	TFEE	44.98
Compliance Check	See BREL	% DFEE < TFEE			8.93
% DPER < TPER	57.27	DPER	39.19	TPER	91.71

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.4500 (2b)	=	127.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.4000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1570	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3070	(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) =	0.2379	(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	0.3033	0.2974	0.2914	0.2617	0.2558	0.2260	0.2260	0.2201	0.2379	0.2558	0.2677	0.2795	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5460	0.5442	0.5425	0.5342	0.5327	0.5255	0.5255	0.5242	0.5283	0.5327	0.5358	0.5391	(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	
Glazed Door (Uw = 0.95)			15.1600	0.9152	13.8748			(27)
Window (Uw = 0.95)			0.9000	0.9152	0.8237			(27)
Door			1.8900	0.8000	1.5120			(26)
External Wall 1	47.7800	17.9500	29.8300	0.1500	4.4745	14.0000	417.6200	(29a)
External Roof 1	52.0000		52.0000	0.1000	5.2000	9.0000	468.0000	(30)
Total net area of external elements Aum(A, m2)			99.7800					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	25.8850			(33)
Party Wall 1	22.0700	0.0000	0.0000	20.0000	441.4000 (32)
Party Floor 1	52.0000			40.0000	2080.0000 (32d)
Internal Wall 1	44.2000			9.0000	397.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3804.8200 (34)		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		73.1696 (35)		
List of Thermal Bridges				
K1 Element		Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)		19.5000	0.0700	1.3650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation		5.7000	0.4430	2.5251
E16 Corner (normal)		7.3500	0.0900	0.6615
E17 Corner (inverted – internal area greater than external area)		2.4500	-0.0900	-0.2205
E18 Party wall between dwellings		4.9000	0.0600	0.2940
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)		9.0100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)		9.0100	0.1200	1.0812
E1 Steel lintel with perforated steel base plate		8.0400	0.0500	0.4020
E3 Sill		7.1400	0.0500	0.3570
E4 Jamb		25.4000	0.0500	1.2700
E15 Flat roof with parapet		19.5000	0.3000	5.8500
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				13.5853 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =		39.4703 (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	22.9553	22.8801	22.8065	22.4607	22.3960	22.0948	22.0948	22.0391	22.2109	22.3960	22.5269	22.6637	(38)
Heat transfer coeff	62.4255	62.3504	62.2768	61.9310	61.8663	61.5651	61.5651	61.5093	61.6811	61.8663	61.9972	62.1340	(39)
Average = Sum(39)m / 12 =												61.9307	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2005	1.1990	1.1976	1.1910	1.1897	1.1839	1.1839	1.1829	1.1862	1.1897	1.1923	1.1949	(40)
HLP (average)												1.1910	
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												1.7491 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												51.0472 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)
Energy content (annual)										Total = Sum(45)m =		847.7848	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)
								Total per year (kWh/year) = Sum(64)m =				720.6170	(64)
12Total per year (kWh/year)												721	(64)
Electric shower(s)	42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				487.7707	(64a)
Heat gains from water heating, kWh/month	29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(65)

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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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.1446	326.9665	313.2039	304.4125	289.2467	279.8004	269.5588	269.1408	276.9980	285.0548	301.1016	311.0978	(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	
Northeast	13.1800	11.2829	0.4700	0.7000	0.7700	33.9052	(75)
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100	(77)
Southwest	0.9000	36.7938	0.4700	0.7000	0.7700	7.5500	(79)

Solar gains	58.0652	110.1685	180.6511	273.9755	352.6409	370.2215	348.5556	286.7900	212.4837	129.8252	71.5997	48.3646	(83)
Total gains	376.2098	437.1350	493.8550	578.3881	641.8877	650.0220	618.1143	555.9309	489.4817	414.8800	372.7013	359.4625	(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	16.9305	16.9509	16.9709	17.0657	17.0835	17.1671	17.1671	17.1827	17.1348	17.0835	17.0475	17.0099	
alpha	2.1287	2.1301	2.1314	2.1377	2.1389	2.1445	2.1445	2.1455	2.1423	2.1389	2.1365	2.1340	
util living area	0.9239	0.8962	0.8525	0.7642	0.6434	0.5032	0.3929	0.4423	0.6330	0.8142	0.8980	0.9301	(86)
MIT	17.8166	18.1946	18.7896	19.5867	20.2531	20.6915	20.8707	20.8291	20.4666	19.5939	18.5775	17.7425	(87)
Th 2	19.9196	19.9208	19.9219	19.9272	19.9282	19.9329	19.9329	19.9337	19.9311	19.9282	19.9262	19.9241	(88)
util rest of house	0.9148	0.8841	0.8349	0.7358	0.5997	0.4397	0.3104	0.3575	0.5724	0.7849	0.8840	0.9218	(89)
MIT 2	17.0296	17.3995	17.9796	18.7439	19.3573	19.7368	19.8716	19.8478	19.5649	18.7713	17.7857	16.9597	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	17.4803	17.8549	18.4434	19.2266	19.8703	20.2835	20.4438	20.4098	20.0813	19.2424	18.2391	17.4080	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4803	17.8549	18.4434	19.2266	19.8703	20.2835	20.4438	20.4098	20.0813	19.2424	18.2391	17.4080	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8877	0.8547	0.8057	0.7148	0.5972	0.4615	0.3512	0.3969	0.5817	0.7628	0.8559	0.8956	(94)
Useful gains	333.9581	373.6057	397.9172	413.4423	383.3318	299.9801	217.0513	220.6248	284.7124	316.4607	319.0093	321.9408	(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	822.7884	807.7421	743.7991	639.5348	505.4687	349.9069	236.6414	246.6385	368.9358	534.6721	690.5945	820.6686	(97)
Space heating kWh	363.6898	291.7396	257.3362	162.7866	90.8699	0.0000	0.0000	0.0000	0.0000	162.3493	267.5413	371.0535	(98a)
Space heating requirement - total per year (kWh/year)												1967.3661	
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	363.6898	291.7396	257.3362	162.7866	90.8699	0.0000	0.0000	0.0000	0.0000	162.3493	267.5413	371.0535	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1967.3661	
Space heating per m2											(98c) / (4) =	37.8340	(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	578.7120	455.5818	467.4709	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7579	0.8111	0.7744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	438.6067	369.5172	362.0251	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	732.2763	696.5027	625.2917	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	211.4421	243.2773	195.8703	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	52.8605	60.8193	48.9676	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												162.6474	(107)
Energy for space heating												37.8340	(99)
Energy for space cooling												3.1278	(108)

Total 40.9618 (109)
Fabric Energy Efficiency (DFEE) 41.0 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.4500 (2b)	=	127.4000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.4000	(5)

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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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1570	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4070	(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) =	0.3154	(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	0.4022	0.3943	0.3864	0.3470	0.3391	0.2996	0.2996	0.2918	0.3154	0.3391	0.3548	0.3706	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5809	0.5777	0.5746	0.5602	0.5575	0.5449	0.5449	0.5426	0.5497	0.5575	0.5630	0.5687	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099			(27)
External Wall 1	47.7800	12.9900	34.7900	0.1800	6.2622			(29a)
External Roof 1	52.0000		52.0000	0.1100	5.7200			(30)
Total net area of external elements Aum(A, m2)			99.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.5821			(33)
Party Wall 1			22.0700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 73.1696 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	19.5000	0.0700	1.3650
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.0200	0.1140
E16	Corner (normal)	7.3500	0.0900	0.6615
E17	Corner (inverted – internal area greater than external area)	2.4500	-0.0900	-0.2205
E18	Party wall between dwellings	4.9000	0.0600	0.2940
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	9.0100	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	9.0100	0.1200	1.0812
E1	Steel lintel with perforated steel base plate	8.0400	0.0500	0.4020
E3	Sill	7.1400	0.0500	0.3570
E4	Jamb	25.4000	0.0500	1.2700
E15	Flat roof with parapet	19.5000	0.5600	10.9200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.2442 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.8263 (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	24.4207	24.2886	24.1593	23.5515	23.4378	22.9084	22.9084	22.8104	23.1123	23.4378	23.6678	23.9083	(38)
Heat transfer coeff	67.2470	67.1150	66.9856	66.3778	66.2641	65.7347	65.7347	65.6367	65.9386	66.2641	66.4941	66.7346	(39)
Average = Sum(39)m / 12 =												66.3772	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2932	1.2907	1.2882	1.2765	1.2743	1.2641	1.2641	1.2622	1.2681	1.2743	1.2787	1.2834	(40)
HLP (average)												1.2765	
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 1.7491 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)

Average daily hot water use (litres/day) 51.0472 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)
Energy content (annual)										Total = Sum(45)m =		847.7848	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)
									Total per year (kWh/year) = Sum(64)m =			720.6170	(64)
12Total per year (kWh/year)												721	(64)
Electric shower(s)	42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							487.7707	(64a)
Heat gains from water heating, kWh/month	29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0119	85.2631	77.0119	79.5789	77.0119	79.5789	77.0119	77.0119	79.5789	77.0119	79.5789	77.0119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.2750	327.1109	313.3344	304.5474	289.3772	279.9353	269.6893	269.2713	277.1328	285.1853	301.2365	311.2283	(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	
Northeast	9.1100	11.2829	0.6300	0.7000	0.7700	31.4132	(75)
Southeast	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052	(77)

Southwest				0.6200		36.7938		0.6300		0.7000		0.7700	6.9717 (79)
Solar gains	53.7901	102.0587	167.3563	253.8173	326.6983	342.9869	322.9142	265.6903	196.8478	120.2693	66.3283	44.8036 (83)	
Total gains	372.0652	429.1696	480.6906	558.3646	616.0755	622.9221	592.6035	534.9616	473.9806	405.4546	367.5648	356.0319 (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	15.7166	15.7475	15.7779	15.9224	15.9497	16.0782	16.0782	16.1022	16.0285	15.9497	15.8946	15.8373	
alpha	2.0478	2.0498	2.0519	2.0615	2.0633	2.0719	2.0719	2.0735	2.0686	2.0633	2.0596	2.0558	
util living area													
	0.9279	0.9034	0.8649	0.7855	0.6737	0.5366	0.4245	0.4737	0.6602	0.8284	0.9041	0.9334 (86)	
MIT	17.5662	17.9381	18.5426	19.3797	20.1049	20.6139	20.8318	20.7831	20.3667	19.4288	18.3717	17.5040 (87)	
Th 2	19.8462	19.8481	19.8501	19.8593	19.8610	19.8690	19.8690	19.8705	19.8659	19.8610	19.8575	19.8539 (88)	
util rest of house													
	0.9189	0.8915	0.8477	0.7573	0.6288	0.4684	0.3331	0.3809	0.5975	0.7994	0.8903	0.9251 (89)	
MIT 2	16.7400	17.1053	17.6968	18.5056	19.1787	19.6253	19.7908	19.7632	19.4335	18.5730	17.5440	16.6837 (90)	
Living area fraction										fLA = Living area / (4) =		0.5727 (91)	
MIT	17.2132	17.5823	18.1812	19.0062	19.7091	20.1915	20.3870	20.3473	19.9679	19.0631	18.0180	17.1535 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.2132	17.5823	18.1812	19.0062	19.7091	20.1915	20.3870	20.3473	19.9679	19.0631	18.0180	17.1535 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8910	0.8610	0.8166	0.7328	0.6222	0.4890	0.3767	0.4221	0.6037	0.7747	0.8612	0.8983 (94)	
Useful gains	331.5128	369.4978	392.5448	409.1691	383.3228	304.5941	223.2098	225.7873	286.1645	314.1258	316.5392	319.8203 (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													
	868.3706	851.1705	782.4686	670.8256	530.7181	367.5555	248.9368	259.0864	386.9231	560.7997	725.9831	864.4451 (97)	
Space heating kWh													
	399.4222	323.6840	290.1033	188.3927	109.6621	0.0000	0.0000	0.0000	0.0000	183.5254	294.7996	405.2009 (98a)	
Space heating requirement - total per year (kWh/year)												2194.7902	
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													
	399.4222	323.6840	290.1033	188.3927	109.6621	0.0000	0.0000	0.0000	0.0000	183.5254	294.7996	405.2009 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2194.7902	
Space heating per m2											(98c) / (4) =	42.2075 (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	617.9064	486.4369	498.8388	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7157	0.7731	0.7348	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	442.2326	376.0585	366.5716	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	700.4550	666.5446	600.6457	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	185.9201	216.1217	174.1511	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)	
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	46.4800	54.0304	43.5378	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												144.0482 (107)	
Energy for space heating												42.2075 (99)	
Energy for space cooling												2.7702 (108)	
Total												44.9777 (109)	
Fabric Energy Efficiency (TFEE)												45.0 (109)	

Full SAP Calculation Printout

Property Reference	Flat 402 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 402 WCS - Green	Prop Type Ref	Flat 402 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	82 B	DER	3.99	TER	18.11
Environmental	97 A	% DER < TER			77.97
CO_2 Emissions (t/year)	0.19	DFEE	49.46	TFEE	47.56
Compliance Check	See BREL	% DFEE < TFEE			-3.99
% DPER < TPER	56.53	DPER	42.18	TPER	97.04

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.5200 (2b)	=	131.0400	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.0400	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1526	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3026	(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) =	0.2345	(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	0.2990	0.2932	0.2873	0.2580	0.2521	0.2228	0.2228	0.2169	0.2345	0.2521	0.2639	0.2756	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5447	0.5430	0.5413	0.5333	0.5318	0.5248	0.5248	0.5235	0.5275	0.5318	0.5348	0.5380	(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	
Windows (Uw = 0.95)			15.3900	0.9152	14.0853			(27)
Glazed Doors (Uw = 0.95)			2.0500	0.9152	1.8762			(27)
Solid Door			2.0000	0.9500	1.9000			(26)
External Wall 1	57.9100	19.4400	38.4700	0.1500	5.7705	14.0000	538.5800	(29a)
External Roof 1	52.0000		52.0000	0.1000	5.2000	9.0000	468.0000	(30)
Total net area of external elements Aum(A, m2)			109.9100					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	28.8320			(33)
Party Wall 1	19.3000	0.0000	0.0000	20.0000	386.0000 (32)
Party Floor 1	52.0000			40.0000	2080.0000 (32d)
Internal Wall 1	71.6500			9.0000	644.8500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4117.4300 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		79.1813 (35)	
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	5.0600	0.0600	0.3036
E16 Corner (normal)	5.0600	0.0900	0.4554
E17 Corner (inverted – internal area greater than external area)	2.5300	-0.0900	-0.2277
E7 Party floor between dwellings (in blocks of flats)	22.8900	0.0700	1.6023
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	9.9600	0.4430	4.4123
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.6300	0.0000	0.0000
E15 Flat roof with parapet	22.8900	0.5600	12.8184
E1 Steel lintel with perforated steel base plate	9.3900	0.0500	0.4695
E3 Sill	8.4400	0.0500	0.4220
E4 Jamb	25.0000	0.0500	1.2500
E24 Eaves (insulation at ceiling level - inverted)	9.9600	0.2400	2.3904
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			23.8962 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		52.7281 (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	23.5550	23.4799	23.4063	23.0607	22.9960	22.6950	22.6950	22.6392	22.8109	22.9960	23.1268	23.2636	(38)
Heat transfer coeff	76.2831	76.2081	76.1345	75.7888	75.7242	75.4231	75.4231	75.3674	75.5391	75.7242	75.8550	75.9918	(39)
Average = Sum(39)m / 12 =												75.7885	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4670	1.4655	1.4641	1.4575	1.4562	1.4504	1.4504	1.4494	1.4527	1.4562	1.4587	1.4614	(40)
HLP (average)												1.4575	
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												1.7491	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)
Average daily hot water use (litres/day)												51.0472	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)
Energy content (annual)										Total = Sum(45)m =		847.7848	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)
									Total per year (kWh/year) = Sum(64)m =			720.6170	(64)
12Total per year (kWh/year)												721	(64)
Electric shower(s)	42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			487.7707	(64a)
Heat gains from water heating, kWh/month	29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.1446	326.9665	313.2039	304.4125	289.2467	279.8004	269.5588	269.1408	276.9980	285.0548	301.1016	311.0978	(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	
Southeast	13.2300	36.7938	0.4700	0.7000	0.7700	110.9849	(77)
Northwest	2.1600	11.2829	0.4700	0.7000	0.7700	5.5565	(81)
Southeast	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(77)

Solar gains	133.7387	229.6521	319.1225	403.6254	459.5943	459.5699	441.7015	399.4418	348.3080	255.1363	160.5242	114.2350	(83)
Total gains	451.8832	556.6186	632.3263	708.0379	748.8411	739.3703	711.2603	668.5826	625.3060	540.1911	461.6259	425.3328	(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	14.9932	15.0080	15.0225	15.0910	15.1039	15.1642	15.1642	15.1754	15.1409	15.1039	15.0779	15.0507	
alpha	1.9995	2.0005	2.0015	2.0061	2.0069	2.0109	2.0109	2.0117	2.0094	2.0069	2.0052	2.0034	
util living area	0.9150	0.8760	0.8276	0.7490	0.6467	0.5199	0.4068	0.4412	0.6054	0.7827	0.8829	0.9234	(86)
MIT	17.5747	18.0554	18.6862	19.4553	20.1211	20.6063	20.8298	20.7929	20.4292	19.5424	18.4175	17.4743	(87)
Th 2	19.7124	19.7134	19.7145	19.7195	19.7205	19.7249	19.7249	19.7257	19.7232	19.7205	19.7186	19.7166	(88)
util rest of house	0.9035	0.8600	0.8050	0.7149	0.5956	0.4439	0.3064	0.3405	0.5336	0.7453	0.8649	0.9130	(89)
MIT 2	16.6575	17.1239	17.7337	18.4661	19.0758	19.4913	19.6539	19.6337	19.3587	18.5694	17.4911	16.5623	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.2527	17.7283	18.3518	19.1079	19.7540	20.2147	20.4169	20.3858	20.0533	19.2007	18.0922	17.1541	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2527	17.7283	18.3518	19.1079	19.7540	20.2147	20.4169	20.3858	20.0533	19.2007	18.0922	17.1541	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8744	0.8289	0.7761	0.6964	0.5971	0.4746	0.3629	0.3949	0.5537	0.7275	0.8358	0.8850	(94)
Useful gains	395.1460	461.3608	490.7695	493.1000	447.1188	350.9400	258.1311	264.0499	346.2126	393.0114	385.8412	376.4316	(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	988.0698	977.6195	902.3270	773.6474	609.8860	423.4797	287.8801	300.4025	449.7062	651.2805	833.8146	984.4018	(97)
Space heating kWh	441.1353	346.9259	306.1987	201.9942	121.0988	0.0000	0.0000	0.0000	0.0000	192.1522	322.5408	452.3298	(98a)
Space heating requirement - total per year (kWh/year)												2384.3757	
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	441.1353	346.9259	306.1987	201.9942	121.0988	0.0000	0.0000	0.0000	0.0000	192.1522	322.5408	452.3298	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2384.3757	
Space heating per m2											(98c) / (4) =	45.8534	(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	708.9773	558.1310	572.7920	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7214	0.7803	0.7556	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	511.4636	435.5314	432.7935	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	836.7095	805.3746	756.9625	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	234.1771	275.1633	241.1817	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	58.5443	68.7908	60.2954	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												187.6305	(107)
Energy for space heating												45.8534	(99)
Energy for space cooling												3.6083	(108)

Total 49.4617 (109)
Fabric Energy Efficiency (DFEE) 49.5 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.5200 (2b)	=	131.0400 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.0400	(5)

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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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1526	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4026	(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) =	0.3120	(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	0.3978	0.3900	0.3822	0.3432	0.3354	0.2964	0.2964	0.2886	0.3120	0.3354	0.3510	0.3666	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5791	0.5761	0.5731	0.5589	0.5563	0.5439	0.5439	0.5417	0.5487	0.5563	0.5616	0.5672	(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			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			10.9900	1.1450	12.5840			(27)
External Wall 1	57.9100	12.9900	44.9200	0.1800	8.0856			(29a)
External Roof 1	52.0000		52.0000	0.1100	5.7200			(30)
Total net area of external elements Aum(A, m2)			109.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.3896			(33)
Party Wall 1			19.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.1813 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E18 Party wall between dwellings	5.0600	0.0600	0.3036
E16 Corner (normal)	5.0600	0.0900	0.4554
E17 Corner (inverted – internal area greater than external area)	2.5300	-0.0900	-0.2277
E7 Party floor between dwellings (in blocks of flats)	22.8900	0.0700	1.6023
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	9.9600	0.0200	0.1992
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.6300	0.0000	0.0000
E15 Flat roof with parapet	22.8900	0.5600	12.8184
E1 Steel lintel with perforated steel base plate	9.3900	0.0500	0.4695
E3 Sill	8.4400	0.0500	0.4220
E4 Jamb	25.0000	0.0500	1.2500
E24 Eaves (insulation at ceiling level - inverted)	9.9600	0.2400	2.3904

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.6831 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.0727 (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	25.0439	24.9110	24.7807	24.1689	24.0544	23.5215	23.5215	23.4229	23.7268	24.0544	24.2860	24.5281	(38)
Heat transfer coeff	73.1165	72.9836	72.8534	72.2416	72.1271	71.5942	71.5942	71.4955	71.7995	72.1271	72.3587	72.6008	(39)

Average = Sum(39)m / 12 = 72.2410

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4061	1.4035	1.4010	1.3893	1.3871	1.3768	1.3768	1.3749	1.3808	1.3871	1.3915	1.3962	(40)
HLP (average)												1.3893	
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 1.7491 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)

Average daily hot water use (litres/day) 51.0472 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)

Energy content (annual) Total = Sum(45)m = 847.7848

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

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

Water storage loss:

Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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

74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)

Total per year (kWh/year) = Sum(64)m = 720.6170 (64)

12Total per year (kWh/year) 721 (64)

Electric shower(s)

42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 487.7707 (64a)

Heat gains from water heating, kWh/month

29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0589	85.3152	77.0589	79.6275	77.0589	79.6275	77.0589	77.0589	79.6275	77.0589	79.6275	77.0589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.3221	327.1630	313.3814	304.5960	289.4242	279.9839	269.7363	269.3184	277.1814	285.2323	301.2851	311.2754	(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	
Southeast	9.6300	36.7938	0.6300	0.7000	0.7700	108.2862	(77)
Northwest	1.3600	11.2829	0.6300	0.7000	0.7700	4.6896	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	112.9758	193.9972	269.5730	340.9490	388.2213	388.1983	373.1059	337.4129	294.2248	215.5238	135.6026	96.5002	(83)
Total gains	431.2979	521.1602	582.9544	645.5450	677.6456	668.1822	642.8422	606.7313	571.4062	500.7562	436.8877	407.7755	(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	15.6426	15.6711	15.6991	15.8320	15.8572	15.9752	15.9752	15.9972	15.9295	15.8572	15.8064	15.7537	
alpha	2.0428	2.0447	2.0466	2.0555	2.0571	2.0650	2.0650	2.0665	2.0620	2.0571	2.0538	2.0502	
util living area	0.9194	0.8847	0.8413	0.7678	0.6695	0.5415	0.4255	0.4594	0.6243	0.7959	0.8893	0.9270	(86)
MIT	17.6444	18.0917	18.6925	19.4502	20.1102	20.6034	20.8293	20.7935	20.4304	19.5592	18.4744	17.5621	(87)
Th 2	19.7587	19.7606	19.7625	19.7716	19.7733	19.7812	19.7812	19.7826	19.7781	19.7733	19.7698	19.7663	(88)
util rest of house	0.9087	0.8700	0.8205	0.7360	0.6207	0.4675	0.3263	0.3605	0.5553	0.7609	0.8725	0.9172	(89)
MIT 2	16.7537	17.1894	17.7731	18.5011	19.1107	19.5401	19.7071	19.6875	19.4069	18.6233	17.5785	16.6780	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.3316	17.7748	18.3696	19.1169	19.7592	20.2301	20.4353	20.4051	20.0710	19.2306	18.1598	17.2516	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3316	17.7748	18.3696	19.1169	19.7592	20.2301	20.4353	20.4051	20.0710	19.2306	18.1598	17.2516	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8809	0.8400	0.7921	0.7166	0.6201	0.4962	0.3815	0.4133	0.5732	0.7428	0.8445	0.8905	(94)
Useful gains	379.9393	437.7591	461.7339	462.5866	420.2182	331.5733	245.2661	250.7498	327.5323	371.9384	368.9585	363.1300	(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	952.8273	939.6506	864.7436	738.0851	581.2891	403.0791	274.5822	286.3497	428.7136	622.4968	800.2741	947.5567	(97)
Space heating kWh	426.2287	337.2711	299.8392	198.3589	119.8367	0.0000	0.0000	0.0000	0.0000	186.4155	310.5472	434.8135	(98a)
Space heating requirement - total per year (kWh/year)												2313.3108	
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	426.2287	337.2711	299.8392	198.3589	119.8367	0.0000	0.0000	0.0000	0.0000	186.4155	310.5472	434.8135	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2313.3108	
Space heating per m2											(98c) / (4) =	44.4867	(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	672.9856	529.7972	543.3660	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7109	0.7720	0.7478	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	478.4098	409.0047	406.3473	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	753.3036	725.2147	684.4831	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	197.9236	235.2602	206.9330	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.4809	58.8151	51.7333	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												160.0292	(107)
Energy for space heating												44.4867	(99)
Energy for space cooling												3.0775	(108)
Total												47.5642	(109)
Fabric Energy Efficiency (TFEE)												47.6	(109)

Full SAP Calculation Printout

Property Reference	Flat 403 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 403 VL - Be Green	Prop Type Ref	Flat 403 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	81 B	DER	4.00	TER	19.27
Environmental	97 A	% DER < TER			79.24
CO_2 Emissions (t/year)	0.19	DFEE	48.23	TFEE	54.42
Compliance Check	See BREL	% DFEE < TFEE			11.38
% DPER < TPER	58.84	DPER	42.34	TPER	102.88

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.4500 (2b)	=	127.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.4000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1570	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3070	(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) =	0.2379	(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	0.3033	0.2974	0.2914	0.2617	0.2558	0.2260	0.2260	0.2201	0.2379	0.2558	0.2677	0.2795	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5460	0.5442	0.5425	0.5342	0.5327	0.5255	0.5255	0.5242	0.5283	0.5327	0.5358	0.5391	(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	
Glazed Door (Uw = 0.95)			17.1000	0.9152	15.6503			(27)
Window (Uw = 0.95)			1.8000	0.9152	1.6474			(27)
Door			1.8900	0.8000	1.5120			(26)
External Wall 1	81.6500	20.7900	60.8600	0.1500	9.1290	14.0000	852.0400	(29a)
External Roof 1	52.0000		52.0000	0.1000	5.2000	9.0000	468.0000	(30)
Total net area of external elements Aum(A, m2)			133.6500					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	33.1387		(33)
Party Wall 1	9.9100	0.0000	0.0000	20.0000	198.2000	(32)
Party Floor 1	52.0000			40.0000	2080.0000	(32d)
Internal Wall 1	58.0200			9.0000	522.1800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4120.4200	(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		79.2388	(35)	
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E7 Party floor between dwellings (in blocks of flats)	28.8500	0.0700	2.0195	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.4430	1.9049	
E16 Corner (normal)	9.8000	0.0900	0.8820	
E17 Corner (inverted – internal area greater than external area)	2.4500	-0.0900	-0.2205	
E18 Party wall between dwellings	2.4500	0.0600	0.1470	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5000	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	9.6000	0.0500	0.4800	
E3 Sill	8.7000	0.0500	0.4350	
E4 Jamb	25.4000	0.0500	1.2700	
E15 Flat roof with parapet	28.8500	0.3000	8.6550	
P4 Party wall - Roof (insulation at ceiling level)	3.5000	0.1200	0.4200	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.9929	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		49.1316	(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	22.9553	22.8801	22.8065	22.4607	22.3960	22.0948	22.0948	22.0391	22.2109	22.3960	22.5269	22.6637	(38)
Heat transfer coeff	72.0868	72.0117	71.9381	71.5923	71.5276	71.2264	71.2264	71.1707	71.3424	71.5276	71.6585	71.7953	(39)
Average = Sum(39)m / 12 =												71.5920	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3863	1.3848	1.3834	1.3768	1.3755	1.3697	1.3697	1.3687	1.3720	1.3755	1.3780	1.3807	(40)
HLP (average)												1.3768	
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												1.7491 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												51.0472 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)
Energy content (annual)										Total = Sum(45)m =		847.7848	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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	74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)
									Total per year (kWh/year) = Sum(64)m =			720.6170	(64)
12Total per year (kWh/year)												721	(64)
Electric shower(s)	42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			487.7707	(64a)
Heat gains from water heating, kWh/month	29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.1446	326.9665	313.2039	304.4125	289.2467	279.8004	269.5588	269.1408	276.9980	285.0548	301.1016	311.0978	(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	
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175	(75)
Southeast	5.8200	36.7938	0.4700	0.7000	0.7700	48.8233	(77)
Northwest	1.8000	11.2829	0.4700	0.7000	0.7700	4.6305	(81)

Solar gains	82.4713	151.6556	237.1887	343.6478	430.3325	447.1985	422.8332	355.1083	273.5739	175.6161	100.8169	69.2612	(83)
Total gains	400.6159	478.6221	550.3925	648.0604	719.5792	726.9990	692.3919	624.2491	550.5719	460.6709	401.9186	380.3591	(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	15.8775	15.8941	15.9104	15.9872	16.0017	16.0693	16.0693	16.0819	16.0432	16.0017	15.9724	15.9420	
alpha	2.0585	2.0596	2.0607	2.0658	2.0668	2.0713	2.0713	2.0721	2.0695	2.0668	2.0648	2.0628	
util living area	0.9282	0.8983	0.8527	0.7653	0.6471	0.5102	0.4001	0.4485	0.6358	0.8163	0.9024	0.9348	(86)
MIT	17.5907	18.0093	18.6462	19.4772	20.1790	20.6500	20.8499	20.8045	20.4142	19.4868	18.3968	17.5072	(87)
Th 2	19.7739	19.7750	19.7761	19.7812	19.7821	19.7866	19.7866	19.7874	19.7849	19.7821	19.7802	19.7782	(88)
util rest of house	0.9186	0.8850	0.8330	0.7335	0.5979	0.4379	0.3052	0.3513	0.5673	0.7836	0.8873	0.9260	(89)
MIT 2	16.7109	17.1198	17.7391	18.5324	19.1739	19.5760	19.7221	19.6976	19.4009	18.5653	17.5113	16.6318	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	17.2569	17.6718	18.3020	19.1187	19.7977	20.2425	20.4220	20.3845	20.0298	19.1372	18.0608	17.1751	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2569	17.6718	18.3020	19.1187	19.7977	20.2425	20.4220	20.3845	20.0298	19.1372	18.0608	17.1751	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8919	0.8555	0.8040	0.7137	0.5986	0.4664	0.3566	0.4013	0.5823	0.7630	0.8596	0.9003	(94)
Useful gains	357.3079	409.4548	442.5231	462.5118	430.7413	339.0681	246.8944	250.4803	320.6231	351.4702	345.4721	342.4520	(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	934.0203	919.7178	849.0161	731.5839	579.2073	401.8933	272.2272	283.5818	423.0430	610.6448	785.4340	931.5506	(97)
Space heating kWh	429.0740	342.8967	302.4308	193.7319	110.4587	0.0000	0.0000	0.0000	0.0000	192.8258	316.7725	438.2894	(98a)
Space heating requirement - total per year (kWh/year)												2326.4798	
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	429.0740	342.8967	302.4308	193.7319	110.4587	0.0000	0.0000	0.0000	0.0000	192.8258	316.7725	438.2894	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2326.4798	
Space heating per m2											(98c) / (4) =	44.7400	(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	669.5285	527.0756	540.8970	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7407	0.7954	0.7587	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	495.9026	419.2509	410.3740	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	822.2494	783.3207	705.1441	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	234.9697	270.8679	219.3090	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	58.7424	67.7170	54.8272	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												181.2866	(107)
Energy for space heating												44.7400	(99)
Energy for space cooling												3.4863	(108)

Total 48.2263 (109)
Fabric Energy Efficiency (DFEE) 48.2 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.4500 (2b)	=	127.4000 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.4000	(5)

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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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1570	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4070	(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) =	0.3154	(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	0.4022	0.3943	0.3864	0.3470	0.3391	0.2996	0.2996	0.2918	0.3154	0.3391	0.3548	0.3706	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5809	0.5777	0.5746	0.5602	0.5575	0.5449	0.5449	0.5426	0.5497	0.5575	0.5630	0.5687	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
External Wall 1	81.6500	13.0000	68.6500	0.1800	12.3570			(29a)
External Roof 1	52.0000		52.0000	0.1100	5.7200			(30)
Total net area of external elements Aum(A, m2)			133.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.6884			(33)
Party Wall 1			9.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.2388 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	28.8500	0.0700	2.0195
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.0200	0.0860
E16	Corner (normal)	9.8000	0.0900	0.8820
E17	Corner (inverted – internal area greater than external area)	2.4500	-0.0900	-0.2205
E18	Party wall between dwellings	2.4500	0.0600	0.1470
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5000	0.0000	0.0000
E1	Steel lintel with perforated steel base plate	9.6000	0.0500	0.4800
E3	Sill	8.7000	0.0500	0.4350
E4	Jamb	25.4000	0.0500	1.2700
E15	Flat roof with parapet	28.8500	0.5600	16.1560
P4	Party wall - Roof (insulation at ceiling level)	3.5000	0.1200	0.4200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.6750 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.3634 (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	24.4207	24.2886	24.1593	23.5515	23.4378	22.9084	22.9084	22.8104	23.1123	23.4378	23.6678	23.9083	(38)
Heat transfer coeff	78.7840	78.6520	78.5226	77.9148	77.8011	77.2718	77.2718	77.1737	77.4757	77.8011	78.0312	78.2717	(39)

Average = Sum(39)m / 12 = 77.9143

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5151	1.5125	1.5101	1.4984	1.4962	1.4860	1.4860	1.4841	1.4899	1.4962	1.5006	1.5052	(40)
HLP (average)												1.4984	
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 1.7491 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)

Average daily hot water use (litres/day) 51.0472 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	55.6919	54.1647	52.4972	50.4212	48.5694	46.6448	46.2445	47.9086	49.6154	51.5919	53.6863	55.6136	(44)
Energy conte	88.2023	77.1298	80.6862	69.0240	65.3837	57.3553	55.9287	59.3209	61.1808	70.0097	76.4860	87.0774	(45)

Energy content (annual) Total = Sum(45)m = 847.7848

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

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

Water storage loss:

Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(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

74.9719	65.5603	68.5833	58.6704	55.5762	48.7520	47.5394	50.4227	52.0037	59.5082	65.0131	74.0158	(64)

Total per year (kWh/year) = Sum(64)m = 720.6170 (64)

12Total per year (kWh/year) 721 (64)

Electric shower(s)

42.8812	38.2075	41.7211	39.8139	40.5610	38.6913	39.9810	40.5610	39.8139	41.7211	40.9366	42.8812	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 487.7707 (64a)

Heat gains from water heating, kWh/month

29.4633	25.9420	27.5761	24.6211	24.0343	21.8608	21.8801	22.7459	22.9544	25.3073	26.4874	29.2242	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	39.6012	38.6041	37.0646	34.1960	32.3042	30.3622	29.4087	30.5725	31.8811	34.0152	36.7881	39.2799	(72)
Total internal gains	318.2711	327.1066	313.3304	304.5433	289.3733	279.9312	269.6853	269.2674	277.1287	285.1813	301.2324	311.2244	(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	
Northeast	6.6300	11.2829	0.6300	0.7000	0.7700	22.8617	(75)
Southeast	3.4200	36.7938	0.6300	0.7000	0.7700	38.4568	(77)

Northwest				1.0600		11.2829		0.6300		0.7000		0.7700	3.6551 (81)
Solar gains	64.9735	119.4818	186.8753	270.7613	339.0677	352.3596	333.1604	279.7938	215.5454	138.3607	79.4273	54.5659 (83)	
Total gains	383.2446	446.5883	500.2057	575.3045	628.4409	632.2908	602.8457	549.0611	492.6742	423.5421	380.6597	365.7903 (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	14.5278	14.5522	14.5762	14.6899	14.7114	14.8122	14.8122	14.8310	14.7732	14.7114	14.6680	14.6229	
alpha	1.9685	1.9701	1.9717	1.9793	1.9808	1.9875	1.9875	1.9887	1.9849	1.9808	1.9779	1.9749	
util living area													
	0.9358	0.9130	0.8787	0.8097	0.7101	0.5811	0.4678	0.5148	0.6917	0.8453	0.9144	0.9410 (86)	
MIT	17.2574	17.6394	18.2614	19.1235	19.9082	20.4976	20.7709	20.7138	20.2353	19.2238	18.1045	17.1902 (87)	
Th 2	19.6762	19.6781	19.6800	19.6887	19.6904	19.6980	19.6980	19.6994	19.6951	19.6904	19.6871	19.6836 (88)	
util rest of house													
	0.9266	0.9007	0.8607	0.7799	0.6609	0.5018	0.3563	0.4038	0.6216	0.8145	0.9001	0.9325 (89)	
MIT 2	16.3277	16.7029	17.3122	18.1468	18.8780	19.3952	19.6009	19.5692	19.1930	18.2639	17.1729	16.2660 (90)	
Living area fraction										fLA = Living area / (4) =		0.6206 (91)	
MIT	16.9047	17.2841	17.9012	18.7529	19.5173	20.0793	20.3270	20.2795	19.8398	18.8596	17.7510	16.8396 (92)	
Temperature adjustment												0.0000	
adjusted MIT	16.9047	17.2841	17.9012	18.7529	19.5173	20.0793	20.3270	20.2795	19.8398	18.8596	17.7510	16.8396 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8998	0.8707	0.8298	0.7545	0.6536	0.5268	0.4131	0.4566	0.6304	0.7901	0.8718	0.9068 (94)	
Useful gains	344.8526	388.8592	415.0593	434.0485	410.7358	333.1152	249.0614	250.6881	310.5815	334.6603	331.8550	331.7089 (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													
	993.0459	974.0353	895.2551	767.6871	608.1962	423.3970	287.9902	299.3969	444.6957	642.6071	831.1125	989.3203 (97)	
Space heating kWh													
	482.2558	393.2383	357.2657	240.2198	146.9106	0.0000	0.0000	0.0000	0.0000	229.1124	359.4654	489.2629 (98a)	
Space heating requirement - total per year (kWh/year)												2697.7309	
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													
	482.2558	393.2383	357.2657	240.2198	146.9106	0.0000	0.0000	0.0000	0.0000	229.1124	359.4654	489.2629 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2697.7309	
Space heating per m2											(98c) / (4) =	51.8794 (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	726.3546	571.8111	586.5204	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6583	0.7203	0.6822	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	478.1816	411.8867	400.1161	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	711.4098	678.5203	617.1297	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	167.9243	198.3754	161.4582	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)	
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	41.9811	49.5938	40.3645	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												131.9395 (107)	
Energy for space heating												51.8794 (99)	
Energy for space cooling												2.5373 (108)	
Total												54.4167 (109)	
Fabric Energy Efficiency (TFEE)												54.4 (109)	

Full SAP Calculation Printout

Property Reference	Flat 403 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 403 WCS - Green	Prop Type Ref	Flat 102 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	82 B	DER	3.48	TER	15.55
Environmental	97 A	% DER < TER			77.62
CO_2 Emissions (t/year)	0.23	DFEE	44.07	TFEE	44.41
Compliance Check	See BREL	% DFEE < TFEE			0.75
% DPER < TPER	55.30	DPER	37.09	TPER	82.97

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0000 (1b)	x	2.5200 (2b)	=	181.4400	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 72.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	181.4400	(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	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) =	0.1653 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3153 (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) =	0.2444 (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	0.3116	0.3055	0.2994	0.2688	0.2627	0.2322	0.2322	0.2261	0.2444	0.2627	0.2749	0.2872	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5485	0.5467	0.5448	0.5361	0.5345	0.5270	0.5270	0.5256	0.5299	0.5345	0.5378	0.5412	(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	
Windows (Uw = 0.95)			19.9200	0.9152	18.2312			(27)
Glazed Doors (Uw = 0.95)			4.1000	0.9152	3.7524			(27)
Solid Door			2.0000	0.9500	1.9000			(26)
External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9799	(29a)
External Roof 1	72.0000		72.0000	0.1000	7.2000	9.0000	648.0000	(30)
Total net area of external elements Aum(A, m2)			140.5900					(31)

Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	37.4691		(33)
Party Wall 1	9.5800	0.0000	0.0000	20.0000	191.6000	(32)
Corridor Wall	34.0200	0.0000	0.0000	20.0000	680.4000	(32)
Party Floor 1	72.0000			40.0000	2880.0000	(32d)
Internal Wall 1	88.7000			9.0000	798.3000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5794.2799	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		80.4761	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	10.0800	0.0900	0.9072
E17 Corner (inverted – internal area greater than external area)	2.5200	-0.0900	-0.2268
E18 Party wall between dwellings	2.5200	0.0600	0.1512
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.8600	0.4430	2.1530
E1 Steel lintel with perforated steel base plate	11.3900	0.0500	0.5695
E3 Sill	10.4400	0.0500	0.5220
E4 Jamb	41.0000	0.0500	2.0500
E7 Party floor between dwellings (in blocks of flats)	27.2200	0.0700	1.9054
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3000	0.0000	0.0000
E15 Flat roof with parapet	27.2200	0.5600	15.2432
P4 Party wall - Roof (insulation at ceiling level)	7.3000	0.1200	0.8760

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		24.1507	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	61.6198	(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	32.8444	32.7315	32.6209	32.1012	32.0040	31.5514	31.5514	31.4675	31.7257	32.0040	32.2007	32.4063	(38)
Heat transfer coeff	94.4642	94.3513	94.2407	93.7210	93.6238	93.1712	93.1712	93.0873	93.3455	93.6238	93.8205	94.0261	(39)
Average = Sum(39)m / 12 =												93.7205	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3120	1.3104	1.3089	1.3017	1.3003	1.2940	1.2940	1.2929	1.2965	1.3003	1.3031	1.3059	(40)
HLP (average)												1.3017	
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												2.2937	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	27.0765	26.6744	26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849	(42b)
Hot water usage for other uses	38.1196	36.7335	35.3473	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196	(42c)
Average daily hot water use (litres/day)												59.7584	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.1961	63.4078	61.4554	59.0251	56.8571	54.6040	54.1358	56.0842	58.0827	60.3965	62.8482	65.1046	(44)
Energy conte	103.2547	90.2919	94.4546	80.8024	76.5406	67.1420	65.4725	69.4440	71.6217	81.9574	89.5388	101.9380	(45)
Energy content (annual)										Total = Sum(45)m =		992.4587	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	87.7665	76.7481	80.2864	68.6820	65.0595	57.0707	55.6516	59.0274	60.8785	69.6638	76.1080	86.6473	(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	87.7665	76.7481	80.2864	68.6820	65.0595	57.0707	55.6516	59.0274	60.8785	69.6638	76.1080	86.6473	(64)
								Total per year (kWh/year) = Sum(64)m =				843.5899	(64)
12Total per year (kWh/year)												844	(64)
Electric shower(s)	50.1940	44.7233	48.8361	46.6037	47.4782	45.2896	46.7992	47.4782	46.6037	48.8361	47.9178	50.1940	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				570.9538	(64a)
Heat gains from water heating, kWh/month	34.4901	30.3678	32.2806	28.8214	28.1344	25.5901	25.6127	26.6264	26.8705	29.6250	31.0064	34.2103	(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	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8450	112.7570	101.8450	105.2399	101.8450	105.2399	101.8450	101.8450	105.2399	101.8450	105.2399	101.8450	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	(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)													
	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	(71)
Water heating gains (Table 5)													
	46.3577	45.1902	43.3879	40.0298	37.8151	35.5418	34.4257	35.7882	37.3202	39.8185	43.0645	45.9816	(72)
Total internal gains													
	407.5272	419.3670	401.3726	390.1687	370.3699	358.1555	344.7354	344.0026	354.2095	364.5536	385.3837	398.2419	(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	
Northeast	1.7000	11.2829	0.4700	0.7000	0.7700	4.3732	(75)
Southeast	11.5000	36.7938	0.4700	0.7000	0.7700	96.4722	(77)
Northwest	6.7200	11.2829	0.4700	0.7000	0.7700	17.2870	(81)
Southeast	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(77)
Southwest	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(79)

Solar gains	152.5268	267.0043	384.4372	508.3682	598.6518	607.1831	580.0374	510.7156	427.0459	300.2492	184.0022	129.6834	(83)
Total gains	560.0540	686.3713	785.8099	898.5368	969.0217	965.3386	924.7728	854.7182	781.2554	664.8029	569.3859	527.9253	(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	17.0384	17.0588	17.0789	17.1736	17.1914	17.2749	17.2749	17.2905	17.2426	17.1914	17.1553	17.1178	
alpha	2.1359	2.1373	2.1386	2.1449	2.1461	2.1517	2.1517	2.1527	2.1495	2.1461	2.1437	2.1412	
util living area													
	0.9265	0.8906	0.8420	0.7572	0.6450	0.5105	0.3969	0.4373	0.6146	0.7999	0.8971	0.9342	(86)
MIT	17.8058	18.2594	18.8709	19.6259	20.2555	20.6855	20.8695	20.8346	20.5026	19.6609	18.5984	17.7145	(87)
Th 2	19.8314	19.8327	19.8339	19.8395	19.8406	19.8455	19.8455	19.8464	19.8436	19.8406	19.8384	19.8362	(88)
util rest of house													
	0.9169	0.8768	0.8219	0.7258	0.5974	0.4408	0.3065	0.3456	0.5482	0.7665	0.8817	0.9255	(89)
MIT 2	16.9541	17.3961	17.9890	18.7093	19.2852	19.6536	19.7880	19.7690	19.5164	18.7630	17.7402	16.8678	(90)
Living area fraction										fLA = Living area / (4) =		0.5421	(91)
MIT	17.4158	17.8641	18.4671	19.2062	19.8112	20.2130	20.3743	20.3467	20.0510	19.2497	18.2054	17.3268	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4158	17.8641	18.4671	19.2062	19.8112	20.2130	20.3743	20.3467	20.0510	19.2497	18.2054	17.3268	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8904	0.8474	0.7935	0.7063	0.5961	0.4641	0.3494	0.3870	0.5611	0.7465	0.8540	0.9002	(94)
Useful gains	498.6702	581.6652	623.5785	634.6521	577.6012	448.0183	323.0839	330.8131	438.3658	496.2565	486.2410	475.2417	(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													
	1238.9704	1223.1787	1127.7879	965.9058	759.3967	522.9691	351.6555	367.3858	555.5002	809.8195	1041.9147	1234.2593	(97)
Space heating kWh													
	550.7833	431.0971	375.1318	238.5026	135.2558	0.0000	0.0000	0.0000	0.0000	233.2908	400.0851	564.7091	(98a)
Space heating requirement - total per year (kWh/year)												2928.8557	
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													
	550.7833	431.0971	375.1318	238.5026	135.2558	0.0000	0.0000	0.0000	0.0000	233.2908	400.0851	564.7091	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2928.8557	
Space heating per m2											(98c) / (4) =	40.6786	(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	875.8088	689.4665	707.4638	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7536	0.8095	0.7807	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	660.0222	558.0995	552.3184	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1089.8360	1044.4115	964.5082	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	309.4659	361.8161	306.6692	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	77.3665	90.4540	76.6673	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	244.4878 (107)
Energy for space heating	40.6786 (99)
Energy for space cooling	3.3957 (108)
Total	44.0742 (109)
Fabric Energy Efficiency (DFEE)	44.1 (109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0000 (1b)	x	2.5200 (2b)	=	181.4400 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	181.4400 (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) =	0.1653 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4153 (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) =	0.3219 (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	0.4104	0.4024	0.3943	0.3541	0.3460	0.3058	0.3058	0.2977	0.3219	0.3460	0.3621	0.3782	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5599	0.5468	0.5468	0.5443	0.5518	0.5599	0.5656	0.5715	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			16.0100	1.1450	18.3321			(27)
External Wall 1	68.5900	18.0100	50.5800	0.1800	9.1044			(29a)
External Roof 1	72.0000		72.0000	0.1100	7.9200			(30)
Total net area of external elements Aum(A, m2)			140.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.3565			(33)
Party Wall 1			9.5800	0.0000	0.0000			(32)
Corridor Wall			34.0200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 80.4761 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	10.0800	0.0900	0.9072
E17 Corner (inverted – internal area greater than external area)	2.5200	-0.0900	-0.2268
E18 Party wall between dwellings	2.5200	0.0600	0.1512
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.8600	0.0200	0.0972
E1 Steel lintel with perforated steel base plate	11.3900	0.0500	0.5695
E3 Sill	10.4400	0.0500	0.5220
E4 Jamb	41.0000	0.0500	2.0500

E7 Party floor between dwellings (in blocks of flats)	27.2200	0.0700	1.9054	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3000	0.0000	0.0000	
E15 Flat roof with parapet	27.2200	0.5600	15.2432	
P4 Party wall - Roof (insulation at ceiling level)	7.3000	0.1200	0.8760	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.0949 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.4514 (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	34.9802	34.7844	34.5925	33.6910	33.5223	32.7371	32.7371	32.5917	33.0396	33.5223	33.8635	34.2202	(38)
Heat transfer coeff	94.4316	94.2358	94.0438	93.1423	92.9737	92.1885	92.1885	92.0431	92.4909	92.9737	93.3149	93.6716	(39)

Average = Sum(39)m / 12 = 93.1415

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3115	1.3088	1.3062	1.2936	1.2913	1.2804	1.2804	1.2784	1.2846	1.2913	1.2960	1.3010	(40)
HLP (average)												1.2936	
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 2.2937 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

27.0765	26.6744	26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849	(42b)

Hot water usage for other uses

38.1196	36.7335	35.3473	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196	(42c)

Average daily hot water use (litres/day) 59.7584 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.1961	63.4078	61.4554	59.0251	56.8571	54.6040	54.1358	56.0842	58.0827	60.3965	62.8482	65.1046	(44)
Energy conte	103.2547	90.2919	94.4546	80.8024	76.5406	67.1420	65.4725	69.4440	71.6217	81.9574	89.5388	101.9380	(45)

Energy content (annual) Total = Sum(45)m = 992.4587

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

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

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

87.7665	76.7481	80.2864	68.6820	65.0595	57.0707	55.6516	59.0274	60.8785	69.6638	76.1080	86.6473	(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

87.7665	76.7481	80.2864	68.6820	65.0595	57.0707	55.6516	59.0274	60.8785	69.6638	76.1080	86.6473	(64)

Total per year (kWh/year) = Sum(64)m = 843.5899 (64)

12Total per year (kWh/year) 844 (64)

Electric shower(s)

50.1940	44.7233	48.8361	46.6037	47.4782	45.2896	46.7992	47.4782	46.6037	48.8361	47.9178	50.1940	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 570.9538 (64a)

Heat gains from water heating, kWh/month

34.4901	30.3678	32.2806	28.8214	28.1344	25.5901	25.6127	26.6264	26.8705	29.6250	31.0064	34.2103	(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	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8507	112.7633	101.8507	105.2458	101.8507	105.2458	101.8507	101.8507	105.2458	101.8507	105.2458	101.8507	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	(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)	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	(71)
Water heating gains (Table 5)	46.3577	45.1902	43.3879	40.0298	37.8151	35.5418	34.4257	35.7882	37.3202	39.8185	43.0645	45.9816	(72)
Total internal gains	407.5329	419.3733	401.3783	390.1746	370.3756	358.1614	344.7411	344.0083	354.2154	364.5593	385.3896	398.2476	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

					W/m2	or Table 6b		or Table 6c		Table 6d			
Northeast					1.1300	11.2829		0.6300	0.7000	0.7700		3.8965	(75)
Southeast					9.0300	36.7938		0.6300	0.7000	0.7700		101.5394	(77)
Southwest					1.3700	36.7938		0.6300	0.7000	0.7700		15.4052	(79)
Northwest					4.4800	11.2829		0.6300	0.7000	0.7700		15.4480	(81)
Solar gains	136.2891	238.5762	343.4975	454.2172	534.8724	542.4900	518.2385	456.3102	381.5641	268.2792	164.4130	115.8779	(83)
Total gains	543.8219	657.9495	744.8758	844.3918	905.2480	900.6514	862.9796	800.3184	735.7795	632.8385	549.8026	514.1255	(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	17.0443	17.0797	17.1146	17.2802	17.3116	17.4590	17.4590	17.4866	17.4019	17.3116	17.2483	17.1826	
alpha	2.1363	2.1386	2.1410	2.1520	2.1541	2.1639	2.1639	2.1658	2.1601	2.1541	2.1499	2.1455	
util living area	0.9301	0.8977	0.8538	0.7745	0.6672	0.5325	0.4165	0.4566	0.6338	0.8120	0.9024	0.9371	(86)
MIT	17.7674	18.2011	18.7997	19.5630	20.2073	20.6628	20.8589	20.8230	20.4761	19.6224	18.5691	17.6920	(87)
Th 2	19.8318	19.8339	19.8360	19.8458	19.8477	19.8562	19.8562	19.8578	19.8529	19.8477	19.8439	19.8401	(88)
util rest of house	0.9209	0.8846	0.8347	0.7444	0.6204	0.4624	0.3239	0.3633	0.5681	0.7799	0.8877	0.9287	(89)
MIT 2	16.9170	17.3410	17.9238	18.6581	19.2520	19.6483	19.7932	19.7738	19.5051	18.7340	17.7160	16.8482	(90)
Living area fraction										fLA = Living area / (4) =		0.5421	(91)
MIT	17.3780	17.8073	18.3986	19.1486	19.7699	20.1982	20.3709	20.3425	20.0315	19.2156	18.1785	17.3056	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3780	17.8073	18.3986	19.1486	19.7699	20.1982	20.3709	20.3425	20.0315	19.2156	18.1785	17.3056	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8949	0.8557	0.8061	0.7235	0.6169	0.4845	0.3672	0.4048	0.5792	0.7590	0.8604	0.9040	(94)
Useful gains	486.6849	562.9831	600.4526	610.9341	558.4902	436.3548	316.8802	323.9314	426.1569	480.3536	473.0721	464.7558	(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	1234.9784	1216.3249	1118.9904	954.5819	750.2837	516.0924	347.6343	362.8834	548.6071	801.0267	1033.7847	1227.6235	(97)
Space heating kWh	556.7304	439.0457	385.7921	247.4265	142.6944	0.0000	0.0000	0.0000	0.0000	238.5808	403.7131	567.5735	(98a)
Space heating requirement - total per year (kWh/year)												2981.5564	
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	556.7304	439.0457	385.7921	247.4265	142.6944	0.0000	0.0000	0.0000	0.0000	238.5808	403.7131	567.5735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2981.5564	
Space heating per m2											(98c) / (4) =	41.4105	(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	866.5717	682.1947	699.5274	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7359	0.7944	0.7655	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	637.6847	541.9118	535.4887	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1014.2211	972.1795	900.9181	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	271.1062	320.1192	271.8795	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	67.7765	80.0298	67.9699	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												215.7762	(107)
Energy for space heating												41.4105	(99)
Energy for space cooling												2.9969	(108)
Total												44.4074	(109)
Fabric Energy Efficiency (TFEE)												44.4	(109)

Full SAP Calculation Printout

Property Reference	Flat 501 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 501 VL - Be Green	Prop Type Ref	Flat 501 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	81 B	DER	4.32	TER	20.35
Environmental	97 A	% DER < TER			78.77
CO_2 Emissions (t/year)	0.2	DFEE	54.71	TFEE	56.55
Compliance Check	See BREL	% DFEE < TFEE			3.25
% DPER < TPER	58.17	DPER	45.66	TPER	109.15

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.4700 (2b)	=	123.5000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1619 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3119 (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) =	0.2418 (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	0.3082	0.3022	0.2962	0.2659	0.2599	0.2297	0.2297	0.2236	0.2418	0.2599	0.2720	0.2841	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5475	0.5457	0.5439	0.5354	0.5338	0.5264	0.5264	0.5250	0.5292	0.5338	0.5370	0.5403	(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	
Glazed Door (Uw = 0.95)			14.1600	0.9152	12.9595			(27)
Window (Uw = 0.95)			11.2800	0.9152	10.3237			(27)
Door			1.8900	0.8000	1.5120			(26)
External Wall 1	75.3400	27.3300	48.0100	0.1500	7.2015	14.0000	672.1399	(29a)
External Roof 1	50.0000		50.0000	0.1000	5.0000	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			125.3400					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 36.9967 (33)

Party Floor 1	50.0000	40.0000	2000.0000 (32d)
Internal Wall 1	47.7700	9.0000	429.9300 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3552.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 71.0414 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	30.5000	0.0700	2.1350
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.0600	0.4430	2.6846
E16 Corner (normal)	12.3500	0.0900	1.1115
E17 Corner (inverted – internal area greater than external area)	2.4700	-0.0900	-0.2223
E1 Steel lintel with perforated steel base plate	12.5000	0.0500	0.6250
E3 Sill	11.6000	0.0500	0.5800
E4 Jamb	30.3800	0.0500	1.5190
E15 Flat roof with parapet	30.5000	0.3000	9.1500

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.5828 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.5795 (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	22.3136	22.2384	22.1647	21.8186	21.7538	21.4524	21.4524	21.3965	21.5685	21.7538	21.8848	22.0218	(38)
Heat transfer coeff	76.8931	76.8179	76.7442	76.3981	76.3333	76.0319	76.0319	75.9761	76.1480	76.3333	76.4644	76.6013	(39)

Average = Sum(39)m / 12 = 76.3978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5379	1.5364	1.5349	1.5280	1.5267	1.5206	1.5206	1.5195	1.5230	1.5267	1.5293	1.5320	(40)
HLP (average)												1.5280	
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 1.6901 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 50.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859	(44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684	(45)

Energy content (annual) Total = Sum(45)m = 832.1197
Distribution loss (46)m = 0.15 x (45)m

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

Water storage loss:
Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(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

73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481	(64)

Total per year (kWh/year) = Sum(64)m = 707.3017 (64)
12Total per year (kWh/year) 707 (64)
Electric shower(s)

42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 478.7637 (64a)
Heat gains from water heating, kWh/month

28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													

	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542 (72)
Total internal gains	308.7177	317.2236	303.9058	295.3692	280.6905	271.5357	261.6280	261.2424	268.8523	276.6680	292.2114	301.9060 (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
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)
Northwest	12.1800	11.2829	0.4700	0.7000	0.7700	31.3328 (81)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)

Solar gains	76.9603	151.1377	260.0389	411.4485	542.3178	574.2281	538.7055	435.5931	311.6072	181.3958	95.8312	63.4998 (83)
Total gains	385.6780	468.3613	563.9447	706.8177	823.0083	845.7638	800.3335	696.8355	580.4596	458.0638	388.0427	365.4058 (84)

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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	12.8319	12.8445	12.8568	12.9151	12.9260	12.9773	12.9773	12.9868	12.9575	12.9260	12.9039	12.8808	
alpha	1.8555	1.8563	1.8571	1.8610	1.8617	1.8652	1.8652	1.8658	1.8638	1.8617	1.8603	1.8587	
util living area	0.9224	0.8907	0.8370	0.7335	0.6016	0.4657	0.3659	0.4215	0.6180	0.8083	0.8968	0.9291	(86)
MIT	17.0786	17.5361	18.2904	19.2786	20.0889	20.6057	20.8227	20.7626	20.2917	19.2029	17.9703	16.9891	(87)
Th 2	19.6592	19.6603	19.6614	19.6666	19.6676	19.6721	19.6721	19.6729	19.6703	19.6676	19.6656	19.6636	(88)
util rest of house	0.9120	0.8764	0.8155	0.6985	0.5494	0.3919	0.2704	0.3214	0.5458	0.7737	0.8807	0.9195	(89)
MIT 2	16.1563	16.6030	17.3347	18.2724	19.0055	19.4416	19.5992	19.5679	19.2141	18.2347	17.0419	16.0712	(90)
Living area fraction									fLA = Living area / (4) =			0.6400	(91)
MIT	16.7466	17.2002	17.9463	18.9163	19.6988	20.1866	20.3822	20.3325	19.9038	18.8543	17.6361	16.6586	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7466	17.2002	17.9463	18.9163	19.6988	20.1866	20.3822	20.3325	19.9038	18.8543	17.6361	16.6586	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8805	0.8416	0.7811	0.6760	0.5507	0.4219	0.3233	0.3734	0.5597	0.7480	0.8480	0.8893	(94)
Useful gains	339.5971	394.1728	440.4936	477.7929	453.2183	356.7930	258.7273	260.2203	324.8757	342.6454	329.0656	324.9446	(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	957.0582	944.8737	878.4403	765.2285	610.5784	424.7606	287.5709	298.7786	441.9473	630.0809	805.6366	954.3486	(97)
Space heating kWh	459.3910	370.0710	325.8323	206.9536	117.0760	0.0000	0.0000	0.0000	0.0000	213.8520	343.1311	468.2766	(98a)
Space heating requirement - total per year (kWh/year)												2504.5837	
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	459.3910	370.0710	325.8323	206.9536	117.0760	0.0000	0.0000	0.0000	0.0000	213.8520	343.1311	468.2766	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2504.5837	
Space heating per m2											(98c) / (4) =	50.0917	(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	714.6997	562.6359	577.4180	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7424	0.7920	0.7474	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	530.5878	445.5853	431.5742	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	962.2042	910.5756	791.0216	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	310.7638	345.9527	267.4288	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	77.6910	86.4882	66.8572	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												231.0363	(107)
Energy for space heating												50.0917	(99)
Energy for space cooling												4.6207	(108)
Total												54.7124	(109)
Fabric Energy Efficiency (DFEE)												54.7	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.4700 (2b)	=	123.5000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	123.5000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1619	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4119	(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) =	0.3193	(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	0.4071	0.3991	0.3911	0.3512	0.3432	0.3033	0.3033	0.2953	0.3193	0.3432	0.3592	0.3751	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5828	0.5796	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			10.6100	1.1450	12.1489			(27)
External Wall 1	75.3400	12.5000	62.8400	0.1800	11.3112			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			125.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8501			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							71.0414	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	30.5000	0.0700	2.1350
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	6.0600	0.0200	0.1212
E16	Corner (normal)	12.3500	0.0900	1.1115
E17	Corner (inverted – internal area greater than external area)	2.4700	-0.0900	-0.2223
E1	Steel lintel with perforated steel base plate	12.5000	0.0500	0.6250
E3	Sill	11.6000	0.0500	0.5800
E4	Jamb	30.3800	0.0500	1.5190
E15	Flat roof with parapet	30.5000	0.5600	17.0800

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	22.9494	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 53.7995	(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	23.7539	23.6228	23.4942	22.8906	22.7777	22.2520	22.2520	22.1546	22.4545	22.7777	23.0062	23.2450	(38)
Heat transfer coeff													

	77.5533	77.4222	77.2937	76.6901	76.5771	76.0514	76.0514	75.9541	76.2539	76.5771	76.8056	77.0445 (39)
Average = Sum(39)m / 12 =												76.6895
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5511	1.5484	1.5459	1.5338	1.5315	1.5210	1.5210	1.5191	1.5251	1.5315	1.5361	1.5409 (40)
HLP (average)												1.5338
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												1.6901 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses												
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												50.1040 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	54.6627	53.1639	51.5272	49.4895	47.6720	45.7830	45.3900	47.0234	48.6986	50.6385	52.6942	54.5859 (44)
Energy conte	86.5724	75.7046	79.1954	67.7487	64.1757	56.2956	54.8953	58.2247	60.0502	68.7160	75.0726	85.4684 (45)
Energy content (annual)										Total = Sum(45)m =		832.1197
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481 (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												
	73.5866	64.3489	67.3161	57.5864	54.5493	47.8512	46.6610	49.4910	51.0427	58.4086	63.8117	72.6481 (64)
									Total per year (kWh/year) = Sum(64)m =			707.3017 (64)
12Total per year (kWh/year)												707 (64)
Electric shower(s)												
	42.0893	37.5019	40.9507	39.0787	39.8120	37.9768	39.2427	39.8120	39.0787	40.9507	40.1807	42.0893 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					478.7637 (64a)
Heat gains from water heating, kWh/month												
	28.9190	25.4627	27.0667	24.1663	23.5903	21.4570	21.4759	22.3258	22.5304	24.8398	25.9981	28.6844 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	74.4150	82.3880	74.4150	76.8955	74.4150	76.8955	74.4150	74.4150	76.8955	74.4150	76.8955	74.4150 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (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)												
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)												
	38.8696	37.8910	36.3800	33.5643	31.7074	29.8014	28.8655	30.0077	31.2922	33.3869	36.1085	38.5542 (72)
Total internal gains												
	308.8700	317.3923	304.0582	295.5266	280.8429	271.6931	261.7804	261.3948	269.0098	276.8203	292.3689	302.0583 (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
Northeast	4.7000	11.2829	0.6300	0.7000	0.7700	16.2066 (75)
Southeast	0.8300	36.7938	0.6300	0.7000	0.7700	9.3331 (77)
Northwest	5.0800	11.2829	0.6300	0.7000	0.7700	17.5169 (81)

Solar gains	43.0566	84.5429	145.4288	230.0646	303.2117	321.0419	301.1860	243.5539	174.2549	101.4602	53.6118	35.5275 (83)
Total gains	351.9266	401.9352	449.4869	525.5912	584.0546	592.7350	562.9664	504.9487	443.2647	378.2806	345.9807	337.5858 (84)

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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	12.7227	12.7442	12.7654	12.8659	12.8849	12.9739	12.9739	12.9906	12.9395	12.8849	12.8465	12.8067	
alpha	1.8482	1.8496	1.8510	1.8577	1.8590	1.8649	1.8649	1.8660	1.8626	1.8590	1.8564	1.8538	
util living area	0.9328	0.9130	0.8808	0.8122	0.7125	0.5854	0.4764	0.5275	0.7048	0.8507	0.9131	0.9374	(86)
MIT	16.9370	17.3002	17.9478	18.8801	19.7465	20.4058	20.7177	20.6467	20.0927	18.9903	17.8227	16.8744	(87)
Th 2	19.6494	19.6514	19.6533	19.6622	19.6639	19.6718	19.6718	19.6732	19.6687	19.6639	19.6605	19.6570	(88)
util rest of house	0.9235	0.9010	0.8635	0.7833	0.6642	0.5067	0.3638	0.4157	0.6366	0.8213	0.8990	0.9288	(89)
MIT 2	16.0129	16.3706	17.0067	17.9121	18.7242	19.3087	19.5492	19.5085	19.0640	18.0404	16.8976	15.9556	(90)

Living area fraction fLA = Living area / (4) = 0.6400 (91)

MIT	16.6043	16.9656	17.6090	18.5316	19.3785	20.0109	20.2970	20.2369	19.7224	18.6483	17.4897	16.5436	(92)

Temperature adjustment 0.0000

adjusted MIT	16.6043	16.9656	17.6090	18.5316	19.3785	20.0109	20.2970	20.2369	19.7224	18.6483	17.4897	16.5436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8939	0.8684	0.8292	0.7535	0.6524	0.5285	0.4201	0.4668	0.6398	0.7928	0.8678	0.9002	(94)
Useful gains	314.5937	349.0233	372.7255	396.0337	381.0431	313.2654	236.4951	235.7148	283.5890	299.9065	300.2421	303.9082	(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	954.2409	934.1419	858.6581	738.6511	587.9947	411.5038	281.1637	291.4288	428.7287	616.3179	797.9841	951.0069	(97)
Space heating kWh	475.8975	393.1997	361.5339	246.6845	153.9720	0.0000	0.0000	0.0000	0.0000	235.4101	358.3743	481.4414	(98a)

Space heating requirement - total per year (kWh/year) 2706.5134

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	475.8975	393.1997	361.5339	246.6845	153.9720	0.0000	0.0000	0.0000	0.0000	235.4101	358.3743	481.4414	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2706.5134

Space heating per m2 (98c) / (4) = 54.1303 (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	714.8833	562.7805	577.2508	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6278	0.6885	0.6450	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	448.8200	387.4616	372.3241	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	666.2855	632.9698	566.5789	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	156.5752	182.6581	144.5256	0.0000	0.0000	0.0000	0.0000	(104)

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.1438	45.6645	36.1314	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 120.9397 (107)

Energy for space heating 54.1303 (99)

Energy for space cooling 2.4188 (108)

Total 56.5491 (109)

Fabric Energy Efficiency (TFEE) 56.5 (109)

Full SAP Calculation Printout

Property Reference	House - 10-12 MS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	House - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	74 C	DER	5.19	TER	12.46
Environmental	95 A	% DER < TER			58.35
CO_2 Emissions (t/year)	0.66	DFEE	91.99	TFEE	50.57
Compliance Check	See BREL	% DFEE < TFEE			-81.90
% DPER < TPER	17.73	DPER	53.87	TPER	65.48

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	53.0000	(1a)	x 2.3600	(2a) =	125.0800	(1a) -
Ground floor	9.4400	(1b)	x 3.3700	(2b) =	31.8128	(1b) -
First floor	29.5700	(1c)	x 3.4400	(2c) =	101.7208	(1c) -
Second floor	29.5700	(1d)	x 3.0200	(2d) =	89.3014	(1d) -
Third floor	29.5700	(1e)	x 2.7000	(2e) =	79.8390	(1e) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	151.1500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		427.7540	(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		4 * 10 =	40.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.0935	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			10.0000	(17)
Infiltration rate			0.5935	(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) =	0.4600	(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	0.5865	0.5750	0.5635	0.5060	0.4945	0.4370	0.4370	0.4255	0.4600	0.4945	0.5175	0.5405	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6720	0.6653	0.6587	0.6280	0.6223	0.5955	0.5955	0.5905	0.6058	0.6223	0.6339	0.6461	(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	
Windows (Uw = 1.50)			32.9200	1.4151	46.5849			(27)
Solid Door			3.5900	3.0000	10.7700			(26)

Heatloss Floor 1			53.0000	0.2500	13.2500	(28)
External Wall 1	261.9900	36.5100	225.4800	0.3000	67.6440	(29a)
Sheltered Wall	52.9900		52.9900	0.3000	15.8970	(29a)
Flat Roof	32.9200		32.9200	0.1600	5.2672	(30)
Total net area of external elements Aum(A, m2)			400.9000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		159.4131	(33)
Party Wall 1			76.9300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		80.1800 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	239.5931 (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	94.8545	93.9118	92.9879	88.6480	87.8361	84.0562	84.0562	83.3562	85.5122	87.8361	89.4787	91.1959	(38)
Heat transfer coeff	334.4476	333.5049	332.5810	328.2411	327.4292	323.6493	323.6493	322.9493	325.1053	327.4292	329.0718	330.7890	(39)
Average = Sum(39)m / 12 =												328.2373	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.2127	2.2065	2.2003	2.1716	2.1663	2.1412	2.1412	2.1366	2.1509	2.1663	2.1771	2.1885	(40)
HLP (average)												2.1716	
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												2.9360	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.7076	31.2367	30.5735	29.3508	28.4353	27.4201	26.8718	27.5303	28.2472	29.3335	30.5814	31.6004	(42b)
Hot water usage for other uses	44.6973	43.0719	41.4465	39.8212	38.1958	36.5705	36.5705	38.1958	39.8212	41.4465	43.0719	44.6973	(42c)
Average daily hot water use (litres/day)												70.0318	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.4048	74.3086	72.0201	69.1720	66.6311	63.9906	63.4423	65.7261	68.0684	70.7801	73.6533	76.2976	(44)
Energy conte	121.0066	105.8144	110.6922	94.6931	89.6983	78.6839	76.7279	81.3826	83.9352	96.0479	104.9326	119.4636	(45)
Energy content (annual)										Total = Sum(45)m =		1163.0783	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.8556	89.9422	94.0884	80.4891	76.2436	66.8813	65.2187	69.1752	71.3449	81.6407	89.1927	101.5441	(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	102.8556	89.9422	94.0884	80.4891	76.2436	66.8813	65.2187	69.1752	71.3449	81.6407	89.1927	101.5441	(64)
								Total per year (kWh/year) = Sum(64)m =				988.6166	(64)
12Total per year (kWh/year)												989	(64)
Electric shower(s)	58.8183	52.4076	57.2271	54.6111	55.6359	53.0712	54.8403	55.6359	54.6111	57.2271	56.1510	58.8183	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						669.0549	(64a)
Heat gains from water heating, kWh/month	40.4185	35.5875	37.8289	33.7751	32.9699	29.9881	30.0147	31.2028	31.4890	34.7169	36.3359	40.0906	(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	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.4115	179.8127	162.4115	167.8252	162.4115	167.8252	162.4115	162.4115	167.8252	162.4115	167.8252	162.4115	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.7707	325.1097	316.6956	298.7829	276.1714	254.9198	240.7225	237.3835	245.7976	263.7102	286.3217	307.5733	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	(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)	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	(71)
Water heating gains (Table 5)	54.3259	52.9575	50.8452	46.9098	44.3143	41.6502	40.3424	41.9392	43.7347	46.6626	50.4666	53.8852	(72)
Total internal gains	605.5476	624.9194	596.9918	580.5574	549.9368	531.4348	510.5159	508.7737	524.3971	539.8238	571.6530	590.9095	(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
Northeast	17.6800	11.2829	0.6200	0.7000	0.7700	59.9967 (75)
Southeast	5.7900	36.7938	0.6200	0.7000	0.7700	64.0732 (77)
Southwest	9.4500	36.7938	0.6200	0.7000	0.7700	104.5755 (79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	228.6454	409.3962	613.0874	848.3698	1031.2289	1059.3937	1006.5443	864.6772	693.7081	466.7423	277.4937	193.3245	(83)
Total gains	834.1930	1034.3156	1210.0792	1428.9273	1581.1657	1590.8284	1517.0601	1373.4510	1218.1052	1006.5661	849.1467	784.2340	(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	31.3847	31.4734	31.5608	31.9781	32.0574	32.4318	32.4318	32.5021	32.2866	32.0574	31.8974	31.7318	
alpha	3.0923	3.0982	3.1041	3.1319	3.1372	3.1621	3.1621	3.1668	3.1524	3.1372	3.1265	3.1155	
util living area	0.9976	0.9951	0.9897	0.9736	0.9341	0.8490	0.7352	0.7889	0.9276	0.9845	0.9958	0.9981	(86)
MIT	18.1757	18.4186	18.8421	19.4570	20.0616	20.5670	20.8145	20.7583	20.3322	19.5552	18.7724	18.1525	(87)
Th 2	19.1953	19.1993	19.2031	19.2214	19.2248	19.2408	19.2408	19.2438	19.2346	19.2248	19.2179	19.2106	(88)
util rest of house	0.9967	0.9931	0.9852	0.9602	0.8940	0.7375	0.5193	0.5925	0.8628	0.9743	0.9937	0.9973	(89)
MIT 2	16.7292	16.9738	17.3977	18.0160	18.5963	19.0433	19.2006	19.1809	18.8638	18.1217	17.3396	16.7158	(90)
Living area fraction									fLA = Living area / (4) =			0.0864	(91)
MIT	16.8542	17.0987	17.5225	18.1405	18.7229	19.1750	19.3401	19.3172	18.9906	18.2456	17.4634	16.8399	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8542	17.0987	17.5225	18.1405	18.7229	19.1750	19.3401	19.3172	18.9906	18.2456	17.4634	16.8399	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9892	0.9783	0.9476	0.8775	0.7318	0.5348	0.6035	0.8491	0.9649	0.9902	0.9956	(94)
Useful gains	829.6712	1023.1948	1183.8209	1354.0322	1387.4940	1164.1926	811.2746	828.8996	1034.2978	971.2241	840.8631	780.7649	(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	4198.7254	4068.3162	3665.8798	3033.1058	2299.4919	1480.6824	886.8185	942.1091	1589.9747	2503.3845	3410.3101	4181.1395	(97)
Space heating kWh	2506.5764	2046.3216	1846.6518	1208.9330	678.5265	0.0000	0.0000	0.0000	0.0000	1139.9274	1850.0018	2529.8787	(98a)
Space heating requirement - total per year (kWh/year)												13806.8172	
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	2506.5764	2046.3216	1846.6518	1208.9330	678.5265	0.0000	0.0000	0.0000	0.0000	1139.9274	1850.0018	2529.8787	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13806.8172	
Space heating per m2											(98c) / (4) =	91.3451	(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	3042.3036	2395.0050	2454.4151	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5372	0.6196	0.5654	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1634.4557	1483.8578	1387.7071	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1788.8614	1705.7359	1541.1346	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	111.1721	165.0773	114.1500	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	27.7930	41.2693	28.5375	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												97.5999	(107)
Energy for space heating												91.3451	(99)
Energy for space cooling												0.6457	(108)
Total												91.9909	(109)
Fabric Energy Efficiency (DFEE)												92.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Basement floor	53.0000 (1a)	x	2.3600 (2a)	=	125.0800 (1a)	-
Ground floor	9.4400 (1b)	x	3.3700 (2b)	=	31.8128 (1b)	-
First floor	29.5700 (1c)	x	3.4400 (2c)	=	101.7208 (1c)	-
Second floor	29.5700 (1d)	x	3.0200 (2d)	=	89.3014 (1d)	-
Third floor	29.5700 (1e)	x	2.7000 (2e)	=	79.8390 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	151.1500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	427.7540	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0935	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3435	(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) =	0.2662	(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	0.3394	0.3328	0.3261	0.2928	0.2862	0.2529	0.2529	0.2463	0.2662	0.2862	0.2995	0.3128	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5354	0.5410	0.5448	0.5489	(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			3.5900	1.0000	3.5900			(26)
TER Opening Type (Uw = 1.20)			32.9200	1.1450	37.6947			(27)
Heatloss Floor 1			53.0000	0.1300	6.8900			(28)
External Wall 1	261.9900	36.5100	225.4800	0.1800	40.5864			(29a)
Sheltered Wall	52.9900		52.9900	0.1800	9.5382			(29a)
Flat Roof	32.9200		32.9200	0.1100	3.6212			(30)
Total net area of external elements Aum(A, m2)			400.9000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		101.9205			(33)
Party Wall 1			76.9300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							20.0450	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		121.9655	(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	78.7112	78.3954	78.0859	76.6321	76.3601	75.0939	75.0939	74.8594	75.5816	76.3601	76.9104	77.4856	(38)
Heat transfer coeff	200.6766	200.3609	200.0513	198.5976	198.3256	197.0594	197.0594	196.8249	197.5471	198.3256	198.8758	199.4511	(39)
Average = Sum(39)m / 12 =												198.5963	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3277	1.3256	1.3235	1.3139	1.3121	1.3037	1.3037	1.3022	1.3070	1.3121	1.3158	1.3196	(40)
HLP (average)												1.3139	
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 2.9360 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7076	31.2367	30.5735	29.3508	28.4353	27.4201	26.8718	27.5303	28.2472	29.3335	30.5814	31.6004	(42b)

Hot water usage for other uses

44.6973	43.0719	41.4465	39.8212	38.1958	36.5705	36.5705	38.1958	39.8212	41.4465	43.0719	44.6973	(42c)

Average daily hot water use (litres/day) 70.0318 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.4048	74.3086	72.0201	69.1720	66.6311	63.9906	63.4423	65.7261	68.0684	70.7801	73.6533	76.2976	(44)
Energy conte	121.0066	105.8144	110.6922	94.6931	89.6983	78.6839	76.7279	81.3826	83.9352	96.0479	104.9326	119.4636	(45)
Energy content (annual)										Total = Sum(45)m =		1163.0783	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	102.8556	89.9422	94.0884	80.4891	76.2436	66.8813	65.2187	69.1752	71.3449	81.6407	89.1927	101.5441	(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													
	102.8556	89.9422	94.0884	80.4891	76.2436	66.8813	65.2187	69.1752	71.3449	81.6407	89.1927	101.5441	(64)
										Total per year (kWh/year) = Sum(64)m =		988.6166	(64)
12Total per year (kWh/year)												989	(64)
Electric shower(s)													
	58.8183	52.4076	57.2271	54.6111	55.6359	53.0712	54.8403	55.6359	54.6111	57.2271	56.1510	58.8183	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		669.0549	(64a)
Heat gains from water heating, kWh/month													
	40.4185	35.5875	37.8289	33.7751	32.9699	29.9881	30.0147	31.2028	31.4890	34.7169	36.3359	40.0906	(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	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	146.7984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	162.4115	179.8127	162.4115	167.8252	162.4115	167.8252	162.4115	162.4115	167.8252	162.4115	167.8252	162.4115	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	321.7707	325.1097	316.6956	298.7829	276.1714	254.9198	240.7225	237.3835	245.7976	263.7102	286.3217	307.5733	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	37.6798	(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)													
	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	-117.4387	(71)
Water heating gains (Table 5)													
	54.3259	52.9575	50.8452	46.9098	44.3143	41.6502	40.3424	41.9392	43.7347	46.6626	50.4666	53.8852	(72)
Total internal gains													
	605.5476	624.9194	596.9918	580.5574	549.9368	531.4348	510.5159	508.7737	524.3971	539.8238	571.6530	590.9095	(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	
Northeast	17.6800	11.2829	0.6300	0.7000	0.7700	60.9644	(75)
Southeast	5.7900	36.7938	0.6300	0.7000	0.7700	65.1067	(77)
Southwest	9.4500	36.7938	0.6300	0.7000	0.7700	106.2622	(79)

Solar gains	232.3332	415.9993	622.9759	862.0532	1047.8616	1076.4807	1022.7788	878.6236	704.8969	474.2704	281.9694	196.4426	(83)
Total gains	837.8808	1040.9188	1219.9677	1442.6107	1597.7984	1607.9154	1533.2947	1387.3974	1229.2940	1014.0942	853.6224	787.3522	(84)

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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	52.3057	52.3881	52.4692	52.8533	52.9257	53.2658	53.2658	53.3293	53.1343	52.9257	52.7793	52.6271	
alpha	4.4870	4.4925	4.4979	4.5236	4.5284	4.5511	4.5511	4.5553	4.5423	4.5284	4.5186	4.5085	
util living area													
	0.9985	0.9958	0.9881	0.9577	0.8726	0.7087	0.5463	0.6168	0.8592	0.9792	0.9966	0.9989	(86)

MIT	19.2725	19.4955	19.8345	20.2966	20.6898	20.9161	20.9797	20.9657	20.7884	20.2632	19.6826	19.2359	(87)
Th 2	19.8192	19.8209	19.8224	19.8300	19.8314	19.8379	19.8379	19.8391	19.8354	19.8314	19.8285	19.8255	(88)
util rest of house													
	0.9980	0.9943	0.9836	0.9410	0.8229	0.6085	0.4116	0.4782	0.7846	0.9680	0.9951	0.9985	(89)
MIT 2	18.2542	18.4776	18.8152	19.2700	19.6262	19.8008	19.8331	19.8299	19.7192	19.2464	18.6706	18.2223	(90)
Living area fraction										fLA = Living area / (4) =		0.0864	(91)
MIT	18.3422	18.5655	18.9033	19.3587	19.7181	19.8972	19.9322	19.9280	19.8116	19.3343	18.7581	18.3099	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3422	18.5655	18.9033	19.3587	19.7181	19.8972	19.9322	19.9280	19.8116	19.3343	18.7581	18.3099	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9919	0.9787	0.9322	0.8172	0.6141	0.4230	0.4896	0.7828	0.9613	0.9931	0.9977	(94)
Useful gains	835.3285	1032.5074	1193.9959	1344.8264	1305.6492	987.4701	648.6536	679.2537	962.2573	974.8463	847.6959	785.5325	(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													
	2817.9339	2738.0406	2481.2882	2077.0654	1590.1909	1043.8615	656.6394	694.3978	1128.3111	1732.2303	2318.5058	2814.2363	(97)
Space heating kWh													
	1475.0585	1146.1183	957.7454	527.2121	211.6990	0.0000	0.0000	0.0000	0.0000	563.4937	1058.9831	1509.3556	(98a)
Space heating requirement - total per year (kWh/year)												7449.6657	
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													
	1475.0585	1146.1183	957.7454	527.2121	211.6990	0.0000	0.0000	0.0000	0.0000	563.4937	1058.9831	1509.3556	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7449.6657	
Space heating per m2											(98c) / (4) =	49.2866	(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	1852.3582	1458.2394	1495.8693	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8100	0.8812	0.8361	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1500.3582	1285.0540	1250.7302	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1808.8332	1724.7114	1557.4355	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	222.1020	327.1051	228.1888	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	55.5255	81.7763	57.0472	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												194.3490	(107)
Energy for space heating												49.2866	(99)
Energy for space cooling												1.2858	(108)
Total												50.5724	(109)
Fabric Energy Efficiency (TFEE)												50.6	(109)

Full SAP Calculation Printout

Property Reference	House - 35 New OS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	House - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	77 C	DER	4.63	TER	13.68
Environmental	96 A	% DER < TER			66.15
CO_2 Emissions (t/year)	0.4	DFEE	70.87	TFEE	39.83
Compliance Check	See BREL	% DFEE < TFEE			-77.92
% DPER < TPER	35.09	DPER	48.39	TPER	74.55

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4400 (1b)	x	3.1600 (2b)	=	17.1904 (1b)	-
First floor	33.0000 (1c)	x	3.2500 (2c)	=	107.2500 (1c)	-
Second floor	31.0000 (1d)	x	3.0400 (2d)	=	94.2400 (1d)	-
Third floor	34.0000 (1e)	x	2.8400 (2e)	=	96.5600 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	315.2404	(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	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1269 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		10.0000 (17)
Infiltration rate		0.6269 (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) =	0.4858 (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	0.6194	0.6073	0.5952	0.5344	0.5223	0.4615	0.4615	0.4494	0.4858	0.5223	0.5466	0.5709	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6919	0.6844	0.6771	0.6428	0.6364	0.6065	0.6065	0.6010	0.6180	0.6364	0.6494	0.6629	(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	
Windows (Uw = 1.50)			20.0700	1.4151	28.4009			(27)
Solid Door			1.7900	3.0000	5.3700			(26)
Opening			1.0800	1.4151	1.5283			(27a)

GF			5.4400	0.2500	1.3600	(28a)
1F			27.5600	0.2500	6.8900	(28b)
External Wall 1	70.0600	21.8600	48.2000	0.3000	14.4600	(29a)
Sheltered Wall	41.0800		41.0800	0.3000	12.3240	(29a)
Flat Roof	34.0000	1.0800	32.9200	0.1600	5.2672	(30)
Total net area of external elements Aum(A, m2)			178.1400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.6004	(33)
Party Wall 1			170.3700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		35.6280 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	111.2284 (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	71.9732	71.1982	70.4385	66.8704	66.2028	63.0951	63.0951	62.5196	64.2921	66.2028	67.5533	68.9652	(38)
Heat transfer coeff	183.2016	182.4266	181.6670	178.0988	177.4312	174.3235	174.3235	173.7480	175.5206	177.4312	178.7818	180.1937	(39)
Average = Sum(39)m / 12 =												178.0956	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.7711	1.7636	1.7563	1.7218	1.7153	1.6853	1.6853	1.6797	1.6968	1.7153	1.7284	1.7420	(40)
HLP (average)												1.7217	
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												2.7692	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.5049	30.0519	29.4139	28.2376	27.3568	26.3801	25.8525	26.4860	27.1758	28.2209	29.4214	30.4018	(42b)
Hot water usage for other uses	42.9891	41.4258	39.8626	38.2994	36.7361	35.1729	35.1729	36.7361	38.2994	39.8626	41.4258	42.9891	(42c)
Average daily hot water use (litres/day)												67.3638	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.4940	71.4777	69.2765	66.5369	64.0929	61.5530	61.0254	63.2222	65.4752	68.0835	70.8473	73.3908	(44)
Energy conte	116.3965	101.7833	106.4754	91.0857	86.2813	75.6865	73.8049	78.2822	80.7374	92.3887	100.9349	114.9123	(45)
Energy content (annual)										Total = Sum(45)m =		1118.7692	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	98.9370	86.5158	90.5041	77.4229	73.3391	64.3336	62.7342	66.5399	68.6268	78.5304	85.7947	97.6755	(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	98.9370	86.5158	90.5041	77.4229	73.3391	64.3336	62.7342	66.5399	68.6268	78.5304	85.7947	97.6755	(64)
								Total per year (kWh/year) = Sum(64)m =				950.9538	(64)
12Total per year (kWh/year)												951	(64)
Electric shower(s)	56.5786	50.4120	55.0480	52.5316	53.5174	51.0504	52.7520	53.5174	52.5316	55.0480	54.0129	56.5786	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							643.5785	(64a)
Heat gains from water heating, kWh/month	38.8789	34.2319	36.3880	32.4886	31.7141	28.8460	28.8716	30.0143	30.2896	33.3946	34.9519	38.5635	(65)

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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	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.5607	146.7637	132.5607	136.9794	132.5607	136.9794	132.5607	132.5607	136.9794	132.5607	136.9794	132.5607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.7720	264.4884	257.6432	243.0707	224.6754	207.3865	195.8364	193.1200	199.9652	214.5378	232.9330	250.2220	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	(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)	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	(71)
Water heating gains (Table 5)	52.2566	50.9404	48.9086	45.1231	42.6265	40.0639	38.8059	40.3418	42.0689	44.8852	48.5443	51.8327	(72)
Total internal gains	511.1269	526.7300	503.6501	489.7107	464.4002	448.9673	431.7405	430.5601	443.5511	456.5212	482.9943	499.1529	(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	14.2800	10.6334	0.6200	0.7000	0.7700	45.6692 (74)
Southeast	5.7900	36.7938	0.6200	0.7000	0.7700	64.0732 (77)
South	1.0800	26.0000	0.6200	0.7000	1.0000	10.9680 (82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	120.7104	219.1963	338.1315	486.5184	609.1367	633.6454	598.8194	502.4730	388.5148	252.3562	147.0047	101.7642	(83)
Total gains	631.8373	745.9263	841.7816	976.2292	1073.5369	1082.6127	1030.5599	933.0331	832.0659	708.8774	629.9990	600.9171	(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	39.2100	39.3766	39.5412	40.3334	40.4852	41.2069	41.2069	41.3434	40.9259	40.4852	40.1793	39.8645	
alpha	3.6140	3.6251	3.6361	3.6889	3.6990	3.7471	3.7471	3.7562	3.7284	3.6990	3.6786	3.6576	
util living area	0.9973	0.9948	0.9892	0.9698	0.9179	0.8011	0.6608	0.7248	0.9070	0.9819	0.9952	0.9978	(86)
MIT	18.7383	18.9539	19.3187	19.8660	20.3754	20.7654	20.9188	20.8838	20.5699	19.9202	19.2579	18.7291	(87)
Th 2	19.4903	19.4956	19.5008	19.5253	19.5299	19.5514	19.5514	19.5554	19.5431	19.5299	19.5206	19.5109	(88)
util rest of house	0.9964	0.9928	0.9848	0.9559	0.8753	0.6923	0.4800	0.5519	0.8393	0.9711	0.9930	0.9970	(89)
MIT 2	17.4855	17.7040	18.0702	18.6250	19.1074	19.4441	19.5327	19.5239	19.3009	18.6880	18.0252	17.4905	(90)
Living area fraction									fLA = Living area / (4) =			0.1322	(91)
MIT	17.6511	17.8692	18.2352	18.7890	19.2750	19.6187	19.7159	19.7036	19.4686	18.8508	18.1881	17.6542	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6511	17.8692	18.2352	18.7890	19.2750	19.6187	19.7159	19.7036	19.4686	18.8508	18.1881	17.6542	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9895	0.9791	0.9461	0.8656	0.6984	0.5033	0.5728	0.8346	0.9635	0.9899	0.9954	(94)
Useful gains	628.3119	738.1097	824.1804	923.5695	929.2509	756.1309	518.6913	534.4596	694.4208	683.0173	623.6322	598.1627	(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	2445.9417	2365.9197	2131.8995	1761.2208	1344.0445	874.8818	543.1711	573.9965	942.2937	1463.9568	1982.3522	2424.3569	(97)
Space heating kWh	1352.3165	1093.8883	972.9431	603.1089	308.6064	0.0000	0.0000	0.0000	0.0000	581.0190	978.2784	1358.6885	(98a)
Space heating requirement - total per year (kWh/year)												7248.8492	
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	1352.3165	1093.8883	972.9431	603.1089	308.6064	0.0000	0.0000	0.0000	0.0000	581.0190	978.2784	1358.6885	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7248.8492	
Space heating per m2											(98c) / (4) =	70.0778	(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	1638.6410	1289.9940	1320.4848	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6523	0.7380	0.6830	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1068.8619	952.0159	901.8974	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1197.3423	1139.8572	1030.7630	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.5059	139.7539	95.8760	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.1265	34.9385	23.9690	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												82.0339	(107)
Energy for space heating												70.0778	(99)
Energy for space cooling												0.7931	(108)
Total												70.8709	(109)
Fabric Energy Efficiency (DFEE)												70.9	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4400 (1b)	x	3.1600 (2b)	=	17.1904 (1b)	-
First floor	33.0000 (1c)	x	3.2500 (2c)	=	107.2500 (1c)	-
Second floor	31.0000 (1d)	x	3.0400 (2d)	=	94.2400 (1d)	-
Third floor	34.0000 (1e)	x	2.8400 (2e)	=	96.5600 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	315.2404	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1269	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3769	(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) =	0.2921	(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	0.3724	0.3651	0.3578	0.3213	0.3140	0.2775	0.2775	0.2702	0.2921	0.3140	0.3286	0.3432	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5693	0.5667	0.5640	0.5516	0.5493	0.5385	0.5385	0.5365	0.5427	0.5493	0.5540	0.5589	(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			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.20)			20.0700	1.1450	22.9809			(27)
Opening			1.0800	1.5918	1.7191			(27a)
GF			5.4400	0.1300	0.7072			(28a)
1F			27.5600	0.1300	3.5828			(28b)
External Wall 1	70.0600	21.8600	48.2000	0.1800	8.6760			(29a)
Sheltered Wall	41.0800		41.0800	0.1800	7.3944			(29a)
Flat Roof	34.0000	1.0800	32.9200	0.1100	3.6212			(30)
Total net area of external elements Aum(A, m2)			178.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.4716			(33)
Party Wall 1			170.3700	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							8.9070	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		59.3786	(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	59.2286	58.9485	58.6739	57.3842	57.1429	56.0196	56.0196	55.8116	56.4523	57.1429	57.6311	58.1414	(38)
Heat transfer coeff	118.6072	118.3271	118.0525	116.7628	116.5215	115.3983	115.3983	115.1902	115.8309	116.5215	117.0097	117.5200	(39)
Average = Sum(39)m / 12 =												116.7617	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1466	1.1439	1.1413	1.1288	1.1265	1.1156	1.1156	1.1136	1.1198	1.1265	1.1312	1.1361	(40)
HLP (average)												1.1288	
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 2.7692 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

30.5049	30.0519	29.4139	28.2376	27.3568	26.3801	25.8525	26.4860	27.1758	28.2209	29.4214	30.4018 (42b)

Hot water usage for other uses

42.9891	41.4258	39.8626	38.2994	36.7361	35.1729	35.1729	36.7361	38.2994	39.8626	41.4258	42.9891 (42c)

Average daily hot water use (litres/day) 67.3638 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	73.4940	71.4777	69.2765	66.5369	64.0929	61.5530	61.0254	63.2222	65.4752	68.0835	70.8473	73.3908	(44)
Energy conte	116.3965	101.7833	106.4754	91.0857	86.2813	75.6865	73.8049	78.2822	80.7374	92.3887	100.9349	114.9123	(45)
Energy content (annual)										Total = Sum(45)m =		1118.7692	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	98.9370	86.5158	90.5041	77.4229	73.3391	64.3336	62.7342	66.5399	68.6268	78.5304	85.7947	97.6755	(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													
	98.9370	86.5158	90.5041	77.4229	73.3391	64.3336	62.7342	66.5399	68.6268	78.5304	85.7947	97.6755	(64)
										Total per year (kWh/year) = Sum(64)m =		950.9538	(64)
12Total per year (kWh/year)												951	(64)
Electric shower(s)													
	56.5786	50.4120	55.0480	52.5316	53.5174	51.0504	52.7520	53.5174	52.5316	55.0480	54.0129	56.5786	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						643.5785	(64a)
Heat gains from water heating, kWh/month													
	38.8789	34.2319	36.3880	32.4886	31.7141	28.8460	28.8716	30.0143	30.2896	33.3946	34.9519	38.5635	(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	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	138.4585	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	132.5607	146.7637	132.5607	136.9794	132.5607	136.9794	132.5607	132.5607	136.9794	132.5607	136.9794	132.5607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	261.7720	264.4884	257.6432	243.0707	224.6754	207.3865	195.8364	193.1200	199.9652	214.5378	232.9330	250.2220	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	36.8459	(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)													
	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	-110.7668	(71)
Water heating gains (Table 5)													
	52.2566	50.9404	48.9086	45.1231	42.6265	40.0639	38.8059	40.3418	42.0689	44.8852	48.5443	51.8327	(72)
Total internal gains													
	511.1269	526.7300	503.6501	489.7107	464.4002	448.9673	431.7405	430.5601	443.5511	456.5212	482.9943	499.1529	(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	14.2800	10.6334	0.6300	0.7000	0.7700	46.4058	(74)
Southeast	5.7900	36.7938	0.6300	0.7000	0.7700	65.1067	(77)
South	1.0800	26.0000	0.6300	0.7000	1.0000	11.1450	(82)

Solar gains	122.6574	222.7317	343.5852	494.3655	618.9614	643.8655	608.4777	510.5774	394.7812	256.4264	149.3758	103.4056	(83)
Total gains	633.7843	749.4617	847.2353	984.0762	1083.3616	1092.8328	1040.2183	941.1375	838.3322	712.9477	632.3700	602.5585	(84)

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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	60.5640	60.7074	60.8486	61.5207	61.6481	62.2482	62.2482	62.3606	62.0157	61.6481	61.3909	61.1243
alpha	5.0376	5.0472	5.0566	5.1014	5.1099	5.1499	5.1499	5.1574	5.1344	5.1099	5.0927	5.0750

util living area													
	0.9978	0.9945	0.9854	0.9461	0.8364	0.6438	0.4818	0.5499	0.8164	0.9715	0.9950	0.9983	(86)
MIT	19.6018	19.7968	20.0898	20.4988	20.8153	20.9635	20.9932	20.9871	20.8803	20.4596	19.9630	19.5737	(87)
Th 2	19.9629	19.9651	19.9673	19.9774	19.9793	19.9881	19.9881	19.9897	19.9847	19.9793	19.9754	19.9714	(88)
util rest of house													
	0.9971	0.9927	0.9802	0.9269	0.7843	0.5551	0.3743	0.4358	0.7400	0.9577	0.9930	0.9977	(89)
MIT 2	18.6918	18.8875	19.1790	19.5807	19.8595	19.9723	19.9865	19.9862	19.9209	19.5525	19.0618	18.6704	(90)
Living area fraction										fLA = Living area / (4) =		0.1322	(91)
MIT	18.8121	19.0077	19.2994	19.7020	19.9858	20.1033	20.1195	20.1185	20.0477	19.6723	19.1809	18.7898	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8121	19.0077	19.2994	19.7020	19.9858	20.1033	20.1195	20.1185	20.0477	19.6723	19.1809	18.7898	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9902	0.9757	0.9206	0.7847	0.5657	0.3886	0.4508	0.7454	0.9522	0.9907	0.9968	(94)
Useful gains	631.1676	742.1502	826.6529	905.9007	850.0817	618.2202	404.1869	424.2784	624.9020	678.8606	626.5151	600.6182	(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													
	1721.2378	1669.3249	1511.0017	1261.2772	965.4799	635.0709	406.1439	428.3369	688.9249	1057.1234	1413.5807	1714.5922	(97)
Space heating kWh													
	811.0122	623.0614	509.1555	255.8711	85.8563	0.0000	0.0000	0.0000	0.0000	281.4275	566.6872	828.7966	(98a)
Space heating requirement - total per year (kWh/year)												3961.8678	
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													
	811.0122	623.0614	509.1555	255.8711	85.8563	0.0000	0.0000	0.0000	0.0000	281.4275	566.6872	828.7966	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3961.8678	
Space heating per m2											(98c) / (4) =	38.3011	(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	1084.7436	853.9471	875.4458	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8792	0.9340	0.9005	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	953.7303	797.5729	788.3021	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1209.0581	1150.9291	1040.0553	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	183.8360	262.8970	187.3044	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	45.9590	65.7242	46.8261	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												158.5093	(107)
Energy for space heating												38.3011	(99)
Energy for space cooling												1.5324	(108)
Total												39.8335	(109)
Fabric Energy Efficiency (TFEE)												39.8	(109)

Full SAP Calculation Printout

Property Reference	House - 37 New OS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	House - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	78 C	DER	4.16	TER	12.04
Environmental	96 A	% DER < TER			65.45
CO_2 Emissions (t/year)	0.48	DFEE	64.45	TFEE	37.19
Compliance Check	See BREL	% DFEE < TFEE			-73.32
% DPER < TPER	33.87	DPER	43.46	TPER	65.72

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4400 (1b)	x	3.1600 (2b)	=	17.1904 (1b)	-
First floor	44.0000 (1c)	x	3.2500 (2c)	=	143.0000 (1c)	-
Second floor	44.0000 (1d)	x	3.0400 (2d)	=	133.7600 (1d)	-
Third floor	44.0000 (1e)	x	2.8400 (2e)	=	124.9600 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	418.9104	(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	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0955	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		10.0000	(17)
Infiltration rate		0.5955	(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) =	0.4615	(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	0.5884	0.5769	0.5653	0.5077	0.4961	0.4384	0.4384	0.4269	0.4615	0.4961	0.5192	0.5423	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6731	0.6664	0.6598	0.6289	0.6231	0.5961	0.5961	0.5911	0.6065	0.6231	0.6348	0.6470	(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	
Windows (Uw = 1.50)			20.8200	1.4151	29.4623			(27)
Solid Door			1.7900	3.0000	5.3700			(26)
Opening			1.0800	1.4151	1.5283			(27a)

GF			5.4400	0.2500	1.3600	(28a)
1F			38.5800	0.2500	9.6450	(28b)
External Wall 1	66.3700	22.6100	43.7600	0.3000	13.1280	(29a)
Sheltered Wall	41.0800		41.0800	0.3000	12.3240	(29a)
Flat Roof	44.0000	1.0800	42.9200	0.1600	6.8672	(30)
Total net area of external elements Aum(A, m2)			195.4700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.6848	(33)
Party Wall 1			170.3700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		39.0940 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	118.7788 (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	93.0518	92.1225	91.2116	86.9332	86.1327	82.4063	82.4063	81.7163	83.8417	86.1327	87.7521	89.4451	(38)
Heat transfer coeff	211.8306	210.9013	209.9904	205.7120	204.9115	201.1851	201.1851	200.4950	202.6205	204.9115	206.5309	208.2238	(39)
Average = Sum(39)m / 12 =												205.7081	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5413	1.5345	1.5279	1.4967	1.4909	1.4638	1.4638	1.4588	1.4742	1.4909	1.5027	1.5150	(40)
HLP (average)												1.4967	
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												2.9120	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.5351	31.0667	30.4072	29.1912	28.2806	27.2710	26.7256	27.3805	28.0936	29.1740	30.4150	31.4285	(42b)
Hot water usage for other uses	44.4523	42.8358	41.2194	39.6029	37.9865	36.3700	36.3700	37.9865	39.6029	41.2194	42.8358	44.4523	(42c)
Average daily hot water use (litres/day)												69.6491	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.9873	73.9026	71.6266	68.7941	66.2671	63.6410	63.0956	65.3670	67.6965	70.3933	73.2509	75.8807	(44)
Energy conte	120.3454	105.2363	110.0874	94.1757	89.2083	78.2540	76.3087	80.9380	83.4766	95.5231	104.3593	118.8109	(45)
Energy content (annual)										Total = Sum(45)m =		1156.7236	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	102.2936	89.4508	93.5743	80.0493	75.8270	66.5159	64.8624	68.7973	70.9551	81.1946	88.7054	100.9893	(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	102.2936	89.4508	93.5743	80.0493	75.8270	66.5159	64.8624	68.7973	70.9551	81.1946	88.7054	100.9893	(64)
								Total per year (kWh/year) = Sum(64)m =				983.2150	(64)
12Total per year (kWh/year)												983	(64)
Electric shower(s)	58.4971	52.1214	56.9146	54.3129	55.3320	52.7814	54.5408	55.3320	54.3129	56.9146	55.8444	58.4971	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				665.4011	(64a)
Heat gains from water heating, kWh/month	40.1977	35.3931	37.6222	33.5906	32.7898	29.8243	29.8508	31.0323	31.3170	34.5273	36.1374	39.8716	(65)

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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	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.0875	178.3469	161.0875	166.4571	161.0875	166.4571	161.0875	161.0875	166.4571	161.0875	166.4571	161.0875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.4821	309.6624	301.6481	284.5866	263.0494	242.8076	229.2848	226.1045	234.1188	251.1803	272.7174	292.9593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	(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)	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	(71)
Water heating gains (Table 5)	54.0291	52.6682	50.5675	46.6535	44.0723	41.4227	40.1220	41.7101	43.4958	46.4077	50.1909	53.5908	(72)
Total internal gains	588.2794	607.3582	579.9838	564.3779	534.8899	517.3680	497.1750	495.5828	510.7524	525.3561	556.0461	574.3183	(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	14.5200	10.6334	0.6200	0.7000	0.7700	46.4367 (74)
Southeast	6.3000	36.7938	0.6200	0.7000	0.7700	69.7170 (77)
South	1.0800	26.0000	0.6200	0.7000	1.0000	10.9680 (82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	127.1217	230.2765	353.7775	506.8198	632.7847	657.5418	621.6821	522.7619	405.7540	264.7271	154.7115	107.2339	(83)
Total gains	715.4011	837.6347	933.7612	1071.1977	1167.6746	1174.9099	1118.8571	1018.3446	916.5064	790.0832	710.7576	681.5523	(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	45.0570	45.2555	45.4518	46.3971	46.5784	47.4411	47.4411	47.6044	47.1050	46.5784	46.2132	45.8374	
alpha	4.0038	4.0170	4.0301	4.0931	4.1052	4.1627	4.1627	4.1736	4.1403	4.1052	4.0809	4.0558	
util living area	0.9987	0.9973	0.9941	0.9817	0.9435	0.8413	0.7024	0.7648	0.9323	0.9892	0.9975	0.9989	(86)
MIT	18.9446	19.1339	19.4554	19.9454	20.4096	20.7793	20.9267	20.8941	20.5997	20.0090	19.4157	18.9396	(87)
Th 2	19.6567	19.6617	19.6667	19.6899	19.6943	19.7148	19.7148	19.7186	19.7069	19.6943	19.6855	19.6763	(88)
util rest of house	0.9982	0.9962	0.9916	0.9731	0.9130	0.7495	0.5368	0.6103	0.8812	0.9828	0.9963	0.9986	(89)
MIT 2	17.8082	18.0007	18.3247	18.8263	19.2742	19.6052	19.6956	19.6861	19.4650	18.8960	18.2995	17.8172	(90)
Living area fraction									fLA = Living area / (4) =			0.1430	(91)
MIT	17.9707	18.1628	18.4865	18.9864	19.4366	19.7732	19.8717	19.8589	19.6273	19.0552	18.4592	17.9778	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9707	18.1628	18.4865	18.9864	19.4366	19.7732	19.8717	19.8589	19.6273	19.0552	18.4592	17.9778	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9945	0.9884	0.9665	0.9050	0.7546	0.5598	0.6304	0.8768	0.9779	0.9947	0.9978	(94)
Useful gains	713.4036	833.0008	922.8899	1035.3492	1056.7109	886.5667	626.3834	641.9212	803.6315	772.6549	706.9592	680.0236	(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	2895.8812	2797.1421	2517.0446	2074.8908	1585.3284	1040.7681	658.2144	693.4990	1119.9394	1732.5750	2346.0189	2868.8627	(97)
Space heating kWh	1623.7633	1319.9030	1186.0511	748.4699	393.2914	0.0000	0.0000	0.0000	0.0000	714.1805	1180.1230	1628.4963	(98a)
Space heating requirement - total per year (kWh/year)												8794.2786	
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	1623.7633	1319.9030	1186.0511	748.4699	393.2914	0.0000	0.0000	0.0000	0.0000	714.1805	1180.1230	1628.4963	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8794.2786	
Space heating per m2											(98c) / (4) =	63.9863	(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	1891.1401	1488.7698	1523.7623	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6293	0.7206	0.6641	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1190.1857	1072.7718	1011.9322	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1285.8530	1224.3737	1112.4394	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.8805	112.7918	74.7773	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	17.2201	28.1979	18.6943	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												64.1124	(107)
Energy for space heating												63.9863	(99)
Energy for space cooling												0.4665	(108)
Total												64.4528	(109)
Fabric Energy Efficiency (DFEE)												64.5	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4400 (1b)	x	3.1600 (2b)	=	17.1904 (1b)	-
First floor	44.0000 (1c)	x	3.2500 (2c)	=	143.0000 (1c)	-
Second floor	44.0000 (1d)	x	3.0400 (2d)	=	133.7600 (1d)	-
Third floor	44.0000 (1e)	x	2.8400 (2e)	=	124.9600 (1e)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	418.9104	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0955	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3455	(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) =	0.2678	(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	0.3414	0.3347	0.3280	0.2945	0.2878	0.2544	0.2544	0.2477	0.2678	0.2878	0.3012	0.3146	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5414	0.5324	0.5324	0.5307	0.5358	0.5414	0.5454	0.5495	(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			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.20)			20.8200	1.1450	23.8397			(27)
Opening			1.0800	1.5918	1.7191			(27a)
GF			5.4400	0.1300	0.7072			(28a)
1F			38.5800	0.1300	5.0154			(28b)
External Wall 1	66.3700	22.6100	43.7600	0.1800	7.8768			(29a)
Sheltered Wall	41.0800		41.0800	0.1800	7.3944			(29a)
Flat Roof	44.0000	1.0800	42.9200	0.1100	4.7212			(30)
Total net area of external elements Aum(A, m2)			195.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.0638			(33)
Party Wall 1			170.3700	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.7735	(36)
Point Thermal bridges					(36a) =		0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		62.8373	(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	77.1757	76.8629	76.5562	75.1161	74.8467	73.5924	73.5924	73.3601	74.0755	74.8467	75.3918	75.9616	(38)
Heat transfer coeff	140.0130	139.7001	139.3935	137.9534	137.6840	136.4297	136.4297	136.1974	136.9128	137.6840	138.2290	138.7989	(39)
Average = Sum(39)m / 12 =												137.9521	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0187	1.0164	1.0142	1.0037	1.0018	0.9926	0.9926	0.9910	0.9962	1.0018	1.0057	1.0099	(40)
HLP (average)												1.0037	
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 2.9120 (42)
Hot water usage for mixer showers
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths
31.5351 31.0667 30.4072 29.1912 28.2806 27.2710 26.7256 27.3805 28.0936 29.1740 30.4150 31.4285 (42b)
Hot water usage for other uses
44.4523 42.8358 41.2194 39.6029 37.9865 36.3700 36.3700 37.9865 39.6029 41.2194 42.8358 44.4523 (42c)
Average daily hot water use (litres/day) 69.6491 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	75.9873	73.9026	71.6266	68.7941	66.2671	63.6410	63.0956	65.3670	67.6965	70.3933	73.2509	75.8807	(44)
Energy conte	120.3454	105.2363	110.0874	94.1757	89.2083	78.2540	76.3087	80.9380	83.4766	95.5231	104.3593	118.8109	(45)

Energy content (annual) Total = Sum(45)m = 1156.7236
Distribution loss (46)m = 0.15 x (45)m
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (46)
Water storage loss:
Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
102.2936 89.4508 93.5743 80.0493 75.8270 66.5159 64.8624 68.7973 70.9551 81.1946 88.7054 100.9893 (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
102.2936 89.4508 93.5743 80.0493 75.8270 66.5159 64.8624 68.7973 70.9551 81.1946 88.7054 100.9893 (64)
Total per year (kWh/year) = Sum(64)m = 983.2150 (64)
12Total per year (kWh/year) 983 (64)
Electric shower(s)
58.4971 52.1214 56.9146 54.3129 55.3320 52.7814 54.5408 55.3320 54.3129 56.9146 55.8444 58.4971 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 665.4011 (64a)
Heat gains from water heating, kWh/month
40.1977 35.3931 37.6222 33.5906 32.7898 29.8243 29.8508 31.0323 31.3170 34.5273 36.1374 39.8716 (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	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	145.6023	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	161.0875	178.3469	161.0875	166.4571	161.0875	166.4571	161.0875	161.0875	166.4571	161.0875	166.4571	161.0875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	306.4821	309.6624	301.6481	284.5866	263.0494	242.8076	229.2848	226.1045	234.1188	251.1803	272.7174	292.9593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	37.5602	(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)													
	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	-116.4819	(71)
Water heating gains (Table 5)													
	54.0291	52.6682	50.5675	46.6535	44.0723	41.4227	40.1220	41.7101	43.4958	46.4077	50.1909	53.5908	(72)
Total internal gains													
	588.2794	607.3582	579.9838	564.3779	534.8899	517.3680	497.1750	495.5828	510.7524	525.3561	556.0461	574.3183	(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	14.5200	10.6334	0.6300	0.7000	0.7700	47.1857	(74)
Southeast	6.3000	36.7938	0.6300	0.7000	0.7700	70.8414	(77)
South	1.0800	26.0000	0.6300	0.7000	1.0000	11.1450	(82)

Solar gains	129.1721	233.9907	359.4835	514.9943	642.9910	668.1473	631.7093	531.1935	412.2984	268.9969	157.2069	108.9635	(83)
Total gains	717.4515	841.3489	939.4673	1079.3722	1177.8808	1185.5154	1128.8843	1026.7763	923.0508	794.3530	713.2529	683.2818	(84)

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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	68.1683	68.3209	68.4712	69.1860	69.3214	69.9587	69.9587	70.0780	69.7118	69.3214	69.0480	68.7646
alpha	5.5446	5.5547	5.5647	5.6124	5.6214	5.6639	5.6639	5.6719	5.6475	5.6214	5.6032	5.5843

util living area												
	0.9990	0.9973	0.9924	0.9676	0.8820	0.6970	0.5247	0.5952	0.8592	0.9834	0.9976	0.9993 (86)
MIT	19.7043	19.8728	20.1292	20.4993	20.8064	20.9624	20.9936	20.9876	20.8784	20.4784	20.0309	19.6801 (87)
Th 2	20.0678	20.0697	20.0715	20.0802	20.0819	20.0895	20.0895	20.0909	20.0865	20.0819	20.0786	20.0751 (88)
util rest of house												
	0.9987	0.9964	0.9897	0.9553	0.8402	0.6136	0.4199	0.4852	0.7948	0.9751	0.9966	0.9990 (89)
MIT 2	18.8762	19.0457	19.3021	19.6706	19.9500	20.0722	20.0878	20.0873	20.0176	19.6563	19.2109	18.8578 (90)
Living area fraction										fLA = Living area / (4) =		0.1430 (91)
MIT	18.9947	19.1640	19.4204	19.7891	20.0725	20.1996	20.2174	20.2161	20.1407	19.7739	19.3282	18.9755 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9947	19.1640	19.4204	19.7891	20.0725	20.1996	20.2174	20.2161	20.1407	19.7739	19.3282	18.9755 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9952	0.9870	0.9504	0.8397	0.6243	0.4349	0.5009	0.7993	0.9713	0.9954	0.9986	(94)
Useful gains	716.0926	837.2917	927.2792	1025.8293	989.0382	740.1254	490.9449	514.2802	737.7556	771.5572	709.9642	682.2970	(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													
	2057.4437	1992.6883	1801.0263	1502.1899	1152.7646	763.9471	493.5160	519.7361	827.0480	1263.0936	1690.2913	2050.8188	(97)
Space heating kWh													
	997.9652	776.4266	650.0678	342.9797	121.8124	0.0000	0.0000	0.0000	0.0000	365.7031	705.8356	1018.1803	(98a)
Space heating requirement - total per year (kWh/year)												4978.9706	
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													
	997.9652	776.4266	650.0678	342.9797	121.8124	0.0000	0.0000	0.0000	0.0000	365.7031	705.8356	1018.1803	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4978.9706	
Space heating per m2											(98c) / (4) =	36.2265	(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	1282.4388	1009.5795	1035.1001	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8550	0.9213	0.8822	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1096.5127	930.1428	913.1437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1298.0193	1235.8766	1122.1142	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	145.0848	227.4660	155.4741	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	36.2712	56.8665	38.8685	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												132.0062	(107)
Energy for space heating												36.2265	(99)
Energy for space cooling												0.9605	(108)
Total												37.1870	(109)
Fabric Energy Efficiency (TFEE)												37.2	(109)

Full SAP Calculation Printout

Property Reference	1.F Flat - 39-41 OS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	76 C	DER	5.69	TER	16.75
Environmental	96 A	% DER < TER			66.03
CO_2 Emissions (t/year)	0.26	DFEE	79.29	TFEE	44.43
Compliance Check	See BREL	% DFEE < TFEE			-78.45
% DPER < TPER	33.15	DPER	59.68	TPER	89.28

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	53.0000	(1b)	x 2.8000	(2b) =	148.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		148.4000	(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		10.0000	(17)
Infiltration rate		0.5000	(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) =	0.3875	(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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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	
Windows (Uw = 1.60)			13.3400	1.5038	20.0602			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
GF			53.0000	0.1200	6.3600			(28b)

External Wall 1	56.1100	15.2300	40.8800	0.2100	8.5848	(29a)
Sheltered Wall	17.8600		17.8600	0.2100	3.7506	(29a)
Total net area of external elements Aum(A, m2)			126.9700			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.4256	(33)
Party Wall 1			25.7300	0.0000	0.0000	(32)
Party Ceiling 1			53.0000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		25.3940 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	69.8196 (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	27.9661	27.4917	27.0172	24.6452	24.1707	21.7987	21.7987	21.3242	22.7475	24.1707	25.1196	26.0684	(38)
Heat transfer coeff	97.7856	97.3112	96.8368	94.4647	93.9903	91.6182	91.6182	91.1438	92.5670	93.9903	94.9391	95.8880	(39)

Average = Sum(39)m / 12 = 94.3461

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8450	1.8361	1.8271	1.7824	1.7734	1.7286	1.7286	1.7197	1.7465	1.7734	1.7913	1.8092	(40)
HLP (average)												1.7801	
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												1.7786	(42)
Hot water usage for mixer showers	54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331	(42a)
Hot water usage for baths	23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833	(42b)
Hot water usage for other uses	32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442	(42c)
Average daily hot water use (litres/day)												101.3421	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)										Total = Sum(45)m =		1683.2709	
Distribution loss (46)m = 0.15 x (45)m	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(64)
										Total per year (kWh/year) = Sum(64)m =		2421.2279	(64)
12Total per year (kWh/year)												2421	(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	108.1964	96.3731	103.8136	94.3446	93.6158	86.6776	87.0797	89.1342	88.5900	96.0358	98.8047	107.3877	(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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1887	86.5660	78.1887	80.7950	78.1887	80.7950	78.1887	78.1887	80.7950	78.1887	80.7950	78.1887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	145.4252	143.4124	139.5344	131.0341	125.8277	120.3855	117.0426	119.8040	123.0417	129.0803	137.2288	144.3384	(72)
Total internal gains	428.3101	436.2832	419.9743	405.4506	386.7445	373.6703	360.8813	362.0342	371.9317	383.9937	405.6419	420.3835	(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	9.2400	10.6334	0.6400	0.7000	0.7700	30.5039 (74)
Southeast	4.1000	36.7938	0.6400	0.7000	0.7700	46.8350 (77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.3388	138.0717	208.2113	294.3582	365.8251	379.8466	359.2192	302.8381	237.2896	157.5628	93.7279	65.5105	(83)
Total gains	505.6490	574.3550	628.1855	699.8088	752.5695	753.5169	720.1005	664.8723	609.2213	541.5565	499.3698	485.8940	(84)

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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	37.6390	37.8225	38.0078	38.9622	39.1589	40.1728	40.1728	40.3819	39.7610	39.1589	38.7675	38.3839	
alpha	3.5093	3.5215	3.5339	3.5975	3.6106	3.6782	3.6782	3.6921	3.6507	3.6106	3.5845	3.5589	
util living area	0.9887	0.9813	0.9669	0.9259	0.8376	0.6788	0.5286	0.5826	0.8031	0.9434	0.9807	0.9902	(86)
MIT	18.9657	19.1965	19.5655	20.1020	20.5572	20.8630	20.9588	20.9416	20.7274	20.1525	19.4970	18.9598	(87)
Th 2	19.4387	19.4449	19.4511	19.4824	19.4887	19.5204	19.5204	19.5268	19.5077	19.4887	19.4761	19.4636	(88)
util rest of house	0.9847	0.9748	0.9547	0.8968	0.7722	0.5583	0.3654	0.4177	0.7022	0.9149	0.9727	0.9867	(89)
MIT 2	17.1754	17.4711	17.9391	18.6165	19.1368	19.4497	19.5099	19.5097	19.3373	18.6963	17.8744	17.1831	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	18.1067	18.3687	18.7851	19.3892	19.8757	20.1849	20.2636	20.2545	20.0604	19.4538	18.7184	18.1074	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1067	18.3687	18.7851	19.3892	19.8757	20.1849	20.2636	20.2545	20.0604	19.4538	18.7184	18.1074	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9685	0.9477	0.8946	0.7912	0.6163	0.4507	0.5035	0.7445	0.9141	0.9672	0.9823	(94)
Useful gains	495.4510	556.2620	595.3275	626.0758	595.4349	464.3970	324.5276	334.7676	453.5669	495.0405	482.9795	477.3107	(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	1350.0972	1310.6516	1189.6504	990.8638	768.4364	511.6791	335.6555	351.3154	551.7382	832.1730	1103.0427	1333.5476	(97)
Space heating kWh	635.8568	506.9498	442.1763	262.6474	128.7131	0.0000	0.0000	0.0000	0.0000	250.8267	446.4455	637.0403	(98a)
Space heating requirement - total per year (kWh/year)												3310.6558	
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	635.8568	506.9498	442.1763	262.6474	128.7131	0.0000	0.0000	0.0000	0.0000	250.8267	446.4455	637.0403	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3310.6558	
Space heating per m2											(98c) / (4) =	62.4652	(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	861.2112	677.9748	692.6928	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7751	0.8461	0.8105	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	667.5149	573.6668	561.4472	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	837.4087	800.2887	736.9280	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	122.3235	168.6067	130.5577	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.5809	42.1517	32.6394	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												105.3720	(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 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 1.0000 (306)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating:
Space heating requirement

	635.8568	506.9498	442.1763	262.6474	128.7131	0.0000	0.0000	0.0000	0.0000	250.8267	446.4455	637.0403 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	635.8568	506.9498	442.1763	262.6474	128.7131	0.0000	0.0000	0.0000	0.0000	250.8267	446.4455	637.0403
Space heating requirement												
	635.8568	506.9498	442.1763	262.6474	128.7131	0.0000	0.0000	0.0000	0.0000	250.8267	446.4455	637.0403 (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

	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475
Water heating fuel												
	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475 (310)

Cooling System Energy Efficiency Ratio 4.3000 (314)

Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	7.1118	9.8027	7.5906	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	16.2070	14.6386	16.2070	15.6842	16.2070	15.6842	16.2070	16.2070	15.6842	16.2070	15.6842	16.2070 (331)
Lighting	17.0562	13.6831	12.3201	9.0262	6.9721	5.6963	6.3602	8.2672	10.7383	14.0893	15.9138	17.5302 (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 3310.6558 (307)
Space heating fuel - secondary 0.0000 (309)
Water heating fuel - community heating 2421.2279 (310)
Efficiency of water heater 0.0000 (311)
Electricity used for heat distribution 33.1066 (313)
Space cooling fuel 24.5051 (321)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 190.8246 (330a)
Total electricity for the above, kWh/year 190.8246 (331)
Electricity for lighting (calculated in Appendix L) 137.6532 (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 6084.8666 (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			350.0000	(367)
Space and Water heating from Heat pump	1637.6810	0.1547	146.3776	(367)
Electrical energy for heat distribution (space & water)	33.1066	0.0000	8.5300	(372)
Overall CO2 factor for heat network			0.0440	(386)
Total CO2 associated with community systems			252.2442	(373)
Space and water heating			252.2442	(376)
Space cooling	24.5051	0.1139	2.7917	(377)
Pumps, fans and electric keep-hot	190.8246	0.1387	26.4697	(378)
Energy for lighting	137.6532	0.1443	19.8676	(379)
Total CO2, kg/year			301.3732	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.6900	(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			350.0000	(467a)
Space and Water heating from Heat pump	1637.6810	1.5729	1487.8317	(467)
Electrical energy for heat distribution (space & water)	33.1066	0.0000	88.8832	(472)
Overall CO2 factor for heat network			0.4586	(486)
Total CO2 associated with community systems			2628.4030	(473)
Space and water heating			2628.4030	(476)
Space cooling	24.5051	1.4199	34.7954	(477)
Pumps, fans and electric keep-hot	190.8246	1.5128	288.6794	(478)
Energy for lighting	137.6532	1.5338	211.1371	(479)

Total Primary energy kWh/year 3163.0150 (483)
Dwelling Primary energy Rate (DPER) 59.6800 (484)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	53.0000 (1b)	x	2.8000 (2b)	=	148.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.4000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1348	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3848	(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) =	0.2982	(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	0.3802	0.3727	0.3653	0.3280	0.3206	0.2833	0.2833	0.2758	0.2982	0.3206	0.3355	0.3504	(22b)
Effective ac	0.5723	0.5695	0.5667	0.5538	0.5514	0.5401	0.5401	0.5380	0.5445	0.5514	0.5563	0.5614	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.3600	1.1450	13.0076			(27)
GF			53.0000	0.1300	6.8900			(28b)
External Wall 1	56.1100	13.2500	42.8600	0.1800	7.7148			(29a)
Sheltered Wall	17.8600		17.8600	0.1800	3.2148			(29a)
Total net area of external elements Aum(A, m2)			126.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.7172			(33)
Party Wall 1			25.7300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							6.3485	(36)
Point Thermal bridges					(36a) =		0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		39.0657	(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	28.0255	27.8881	27.7534	27.1206	27.0022	26.4510	26.4510	26.3490	26.6633	27.0022	27.2417	27.4921	(38)
Heat transfer coeff	67.0913	66.9538	66.8191	66.1863	66.0679	65.5168	65.5168	65.4147	65.7291	66.0679	66.3074	66.5578	(39)
Average = Sum(39)m / 12 =												66.1857	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2659	1.2633	1.2607	1.2488	1.2466	1.2362	1.2362	1.2342	1.2402	1.2466	1.2511	1.2558	(40)
HLP (average)												1.2488	

Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7786	(42)
Hot water usage for mixer showers													
	54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331	(42a)
Hot water usage for baths													
	23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833	(42b)
Hot water usage for other uses													
	32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442	(42c)
Average daily hot water use (litres/day)												101.3421	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)											Total = Sum(45)m =	1683.2709	
Distribution loss (46)m = 0.15 x (45)m													
	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	223.1557	197.4919	209.9744	184.7945	179.3044	161.7358	159.6470	165.8259	167.4875	186.5825	198.2084	220.7238	(62)
WWHRS	-24.7049	-21.8492	-22.8792	-18.9449	-17.6560	-15.1083	-14.1617	-15.0595	-15.6317	-18.4280	-20.8767	-24.2474	(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													
	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3843	(64)
12Total per year (kWh/year)												2025	(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													
	96.8974	86.1676	92.5146	83.4100	82.3168	75.7430	75.7807	77.8352	77.6555	84.7367	87.8702	96.0887	(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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	78.3035	86.6931	78.3035	80.9136	78.3035	80.9136	78.3035	78.3035	80.9136	78.3035	80.9136	78.3035	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)													
	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)													
	130.2384	128.2255	124.3475	115.8473	110.6408	105.1987	101.8558	104.6172	107.8548	113.8935	122.0419	129.1515	(72)
Total internal gains													
	416.2381	424.2235	407.9022	393.3824	374.6724	358.6021	345.8093	346.9621	356.8635	371.9217	393.5736	408.3114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8700	10.6334	0.6300	0.7000	0.7700	25.5752	(74)
Southeast	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439	(77)

Solar gains	64.8191	115.7223	174.5142	246.7286	306.6399	318.3965	301.1047	253.8396	198.8895	132.0599	78.5554	54.9053	(83)
Total gains	481.0571	539.9458	582.4164	640.1110	681.3123	676.9985	646.9139	600.8017	555.7530	503.9816	472.1291	463.2167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.8589	54.9716	55.0824	55.6090	55.7087	56.1773	56.1773	56.2649	55.9959	55.7087	55.5074	55.2986	
alpha	4.6573	4.6648	4.6722	4.7073	4.7139	4.7452	4.7452	4.7510	4.7331	4.7139	4.7005	4.6866	
util living area	0.9888	0.9798	0.9608	0.9031	0.7798	0.5934	0.4402	0.4913	0.7327	0.9255	0.9785	0.9905	(86)
MIT	19.7229	19.9122	20.1886	20.5574	20.8348	20.9650	20.9931	20.9886	20.9078	20.5614	20.0870	19.6916	(87)
Th 2	19.8677	19.8697	19.8717	19.8812	19.8829	19.8912	19.8912	19.8927	19.8880	19.8829	19.8794	19.8756	(88)
util rest of house	0.9852	0.9734	0.9483	0.8728	0.7184	0.5014	0.3321	0.3779	0.6440	0.8952	0.9706	0.9875	(89)
MIT 2	18.4176	18.6576	19.0037	19.4525	19.7524	19.8727	19.8892	19.8890	19.8305	19.4694	18.8877	18.3837	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.0966	19.3102	19.6201	20.0273	20.3155	20.4409	20.4634	20.4610	20.3909	20.0374	19.5116	19.0641	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0966	19.3102	19.6201	20.0273	20.3155	20.4409	20.4634	20.4610	20.3909	20.0374	19.5116	19.0641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9820	0.9695	0.9449	0.8772	0.7437	0.5482	0.3885	0.4370	0.6865	0.9001	0.9673	0.9846	(94)
Useful gains	472.4213	523.4750	550.3334	561.5307	506.6931	371.1413	251.3149	262.5524	381.5086	453.6307	456.7082	456.0900	(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	992.7220	964.8183	876.6710	736.4729	569.2054	382.6796	253.1178	265.6496	413.4954	623.5124	822.9814	989.3211	(97)
Space heating kWh	387.1037	296.5827	242.7952	125.9583	46.5092	0.0000	0.0000	0.0000	0.0000	126.3921	263.7167	396.7239	(98a)
Space heating requirement - total per year (kWh/year)												1885.7817	
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	387.1037	296.5827	242.7952	125.9583	46.5092	0.0000	0.0000	0.0000	0.0000	126.3921	263.7167	396.7239	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1885.7817	
Space heating per m2											(98c) / (4) =	35.5808	(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	387.1037	296.5827	242.7952	125.9583	46.5092	0.0000	0.0000	0.0000	0.0000	126.3921	263.7167	396.7239	(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)	419.3973	321.3247	263.0500	136.4662	50.3892	0.0000	0.0000	0.0000	0.0000	136.9361	285.7169	429.8200	(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	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5308	85.2249	84.6452	83.4508	81.6490	79.8000	79.8000	79.8000	79.8000	83.4283	84.9479	85.6023	(217)
Fuel for water heating, kWh/month	232.0228	206.0932	221.0345	198.7393	197.9797	183.7437	182.3124	188.9303	190.2955	201.5555	208.7534	229.5222	(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	16.2699	13.0523	11.7522	8.6101	6.6507	5.4337	6.0670	7.8861	10.2433	13.4398	15.1802	16.7221	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3305	-21.3027	-32.2745	-38.3255	-43.1419	-40.9563	-40.4762	-37.3157	-32.0494	-25.2601	-16.1467	-12.2660	(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	-5.0701	-10.9086	-22.1352	-33.9139	-45.4920	-45.9284	-45.3691	-38.1004	-27.5303	-15.7974	-6.8336	-3.9901	(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												2043.1005	(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	2440.9827 (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)	131.3075 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-654.9144 (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	4046.4763 (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	2043.1005	0.2100	429.0511	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2440.9827	0.2100	512.6064	(264)
Space and water heating			941.6575	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	131.3075	0.1443	18.9517	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-353.8454	0.1335	-47.2275	
PV Unit electricity exported	-301.0690	0.1253	-37.7323	
Total			-84.9598	(269)
Total CO2, kg/year			887.5787	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.7500	(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	2043.1005	1.1300	2308.7035	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2440.9827	1.1300	2758.3104	(278)
Space and water heating			5067.0140	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	131.3075	1.5338	201.4039	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-353.8454	1.4932	-528.3676	
PV Unit electricity exported	-301.0690	0.4600	-138.4957	
Total			-666.8633	(283)
Total Primary energy kWh/year			4731.6554	(286)
Target Primary Energy Rate (TPER)			89.2800	(287)

Full SAP Calculation Printout

Property Reference	2.F Flat - 10-12 MS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	80 C	DER	4.57	TER	13.35
Environmental	97 A	% DER < TER			65.77
CO_2 Emissions (t/year)	0.21	DFEE	55.03	TFEE	28.62
Compliance Check	See BREL	% DFEE < TFEE			-92.29
% DPER < TPER	31.99	DPER	48.31	TPER	71.04

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 2.7400	(2b) =	142.4800	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		142.4800	(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		10.0000 (17)
Infiltration rate		0.5000 (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) =	0.3875 (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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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	
Windows (Uw = 1.50)			13.3000	1.4151	18.8208			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
External Wall 1	51.6200	15.1900	36.4300	0.3000	10.9290			(29a)

Total net area of external elements Aum(A, m2)						51.6200							(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =		35.4198					(33)
Party Wall 1						33.9500	0.0000	0.0000					(32)
Party Floor 1						52.0000							(32d)
Party Ceiling 1						52.0000							(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (Default value 0.200 * total exposed area)												10.3240	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	45.7438	(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	26.8504	26.3950	25.9395	23.6620	23.2065	20.9291	20.9291	20.4736	21.8400	23.2065	24.1175	25.0285	(38)
Heat transfer coeff	72.5942	72.1387	71.6832	69.4058	68.9503	66.6728	66.6728	66.2173	67.5838	68.9503	69.8613	70.7722	(39)
Average = Sum(39)m / 12 =												69.2919	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3960	1.3873	1.3785	1.3347	1.3260	1.2822	1.2822	1.2734	1.2997	1.3260	1.3435	1.3610	(40)
HLP (average)												1.3325	
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												1.7491	(42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405	(42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)
Average daily hot water use (litres/day)												100.4145	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)											Total = Sum(45)m =	1667.8640	
Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
											Total per year (kWh/year) = Sum(64)m =	2405.8210	(64)
12Total per year (kWh/year)												2406	(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	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(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	
Northeast	9.6000	11.2829	0.6200	0.7000	0.7700	32.5774	(75)
Southwest	3.7000	36.7938	0.6200	0.7000	0.7700	40.9449	(79)

Solar gains	73.5223	136.0566	214.9008	314.4489	396.1821	412.6595	389.7984	325.8646	248.9079	158.1211	90.0334	61.6446	(83)
Total gains	496.7767	567.1355	629.9141	715.1171	778.4175	781.9982	746.5366	683.7573	616.5571	537.6764	490.9365	477.0967	(84)

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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	49.7438	50.0579	50.3760	52.0290	52.3727	54.1617	54.1617	54.5342	53.4316	52.3727	51.6898	51.0244	
alpha	4.3163	4.3372	4.3584	4.4686	4.4915	4.6108	4.6108	4.6356	4.5621	4.4915	4.4460	4.4016	
util living area	0.9873	0.9766	0.9523	0.8762	0.7310	0.5300	0.3897	0.4396	0.6910	0.9136	0.9756	0.9892	(86)
MIT	19.5758	19.7994	20.1301	20.5747	20.8558	20.9753	20.9951	20.9919	20.9191	20.5488	20.0200	19.5765	(87)
Th 2	19.7664	19.7731	19.7798	19.8137	19.8205	19.8548	19.8548	19.8617	19.8411	19.8205	19.8069	19.7934	(88)
util rest of house	0.9833	0.9693	0.9372	0.8398	0.6643	0.4419	0.2900	0.3338	0.5988	0.8792	0.9666	0.9857	(89)
MIT 2	18.1604	18.4464	18.8616	19.4122	19.7109	19.8424	19.8535	19.8592	19.7926	19.4026	18.7511	18.1801	(90)
Living area fraction									fLA = Living area / (4) =			0.4683	(91)
MIT	18.8232	19.0800	19.4556	19.9566	20.2470	20.3729	20.3881	20.3896	20.3201	19.9394	19.3453	18.8340	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8232	19.0800	19.4556	19.9566	20.2470	20.3729	20.3881	20.3896	20.3201	19.9394	19.3453	18.8340	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9791	0.9639	0.9323	0.8447	0.6898	0.4825	0.3368	0.3835	0.6389	0.8832	0.9621	0.9819	(94)
Useful gains	486.3794	546.6870	587.2644	604.0865	536.9383	377.3121	251.4308	262.1989	393.9294	474.8860	472.3197	468.4779	(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	1054.2998	1022.9270	928.6988	767.3913	589.3172	384.8936	252.5627	264.1821	420.3793	643.9513	855.4727	1035.6808	(97)
Space heating kWh	422.5328	320.0333	254.0272	117.5795	38.9699	0.0000	0.0000	0.0000	0.0000	125.7845	275.8702	421.9990	(98a)
Space heating requirement - total per year (kWh/year)												1976.7963	
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	422.5328	320.0333	254.0272	117.5795	38.9699	0.0000	0.0000	0.0000	0.0000	125.7845	275.8702	421.9990	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1976.7963	
Space heating per m2										(98c) / (4) =		38.0153	(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	626.7245	493.3789	503.2517	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9268	0.9611	0.9441	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	580.8498	474.2079	475.1365	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	870.2593	830.6368	758.0886	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	208.3748	265.1831	210.5164	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	52.0937	66.2958	52.6291	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												171.0186	(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 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	1.0000	(306)

Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
	422.5328	320.0333	254.0272	117.5795	38.9699	0.0000	0.0000	0.0000	0.0000	125.7845	275.8702	421.9990 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	422.5328	320.0333	254.0272	117.5795	38.9699	0.0000	0.0000	0.0000	0.0000	125.7845	275.8702	421.9990
Space heating requirement												
	422.5328	320.0333	254.0272	117.5795	38.9699	0.0000	0.0000	0.0000	0.0000	125.7845	275.8702	421.9990 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												4.3000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	12.1148	15.4176	12.2393	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	15.5605	14.0546	15.5605	15.0585	15.5605	15.0585	15.5605	15.5605	15.0585	15.5605	15.0585	15.5605 (331)
Lighting	14.1242	11.3310	10.2023	7.4746	5.7736	4.7171	5.2669	6.8461	8.8924	11.6673	13.1782	14.5168 (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												1976.7963 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												19.7680 (313)
Space cooling fuel												39.7718 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)												
mechanical ventilation fans (SFP = 1.0540)												183.2122 (330a)
Total electricity for the above, kWh/year												183.2122 (331)
Electricity for lighting (calculated in Appendix L)												113.9905 (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												4719.5918 (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			350.0000	(367)
Space and Water heating from Heat pump	1252.1764	0.1560	88.1289	(367)
Electrical energy for heat distribution (space & water)	19.7680	0.0000	6.4695	(372)
Overall CO2 factor for heat network			0.0437	(386)
Total CO2 associated with community systems			191.3117	(373)
Space and water heating			191.3117	(376)
Space cooling	39.7718	0.1140	4.5359	(377)
Pumps, fans and electric keep-hot	183.2122	0.1387	25.4138	(378)
Energy for lighting	113.9905	0.1443	16.4523	(379)
Total CO2, kg/year			237.7138	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5700	(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			350.0000	(467a)
Space and Water heating from Heat pump	1252.1764	1.5777	891.0692	(467)
Electrical energy for heat distribution (space & water)	19.7680	0.0000	67.7618	(472)
Overall CO2 factor for heat network			0.4572	(486)
Total CO2 associated with community systems			2003.8125	(473)
Space and water heating			2003.8125	(476)
Space cooling	39.7718	1.4204	56.4905	(477)
Pumps, fans and electric keep-hot	183.2122	1.5128	277.1634	(478)
Energy for lighting	113.9905	1.5338	174.8424	(479)
Total Primary energy kWh/year			2512.3088	(483)

Dwelling Primary energy Rate (DPER) 48.3100 (484)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.7400 (2b)	=	142.4800 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.4800	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1404	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3904	(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) =	0.3025	(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	0.3857	0.3782	0.3706	0.3328	0.3252	0.2874	0.2874	0.2798	0.3025	0.3252	0.3404	0.3555	(22b)
Effective ac	0.5744	0.5715	0.5687	0.5554	0.5529	0.5413	0.5413	0.5392	0.5458	0.5529	0.5579	0.5632	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
External Wall 1	51.6200	13.0000	38.6200	0.1800	6.9516			(29a)
Total net area of external elements Aum(A, m2)			51.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.5630			(33)
Party Wall 1			33.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	2.5810	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	24.1440	(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	27.0072	26.8713	26.7382	26.1128	25.9958	25.4512	25.4512	25.3503	25.6610	25.9958	26.2325	26.4800	(38)
Heat transfer coeff	51.1511	51.0153	50.8822	50.2568	50.1398	49.5951	49.5951	49.4943	49.8049	50.1398	50.3765	50.6240	(39)
Average = Sum(39)m / 12 =												50.2563	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9837	0.9811	0.9785	0.9665	0.9642	0.9538	0.9538	0.9518	0.9578	0.9642	0.9688	0.9735	(40)
HLP (average)												0.9665	
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 1.7491 (42)
Hot water usage for mixer showers
53.5457 52.7410 51.5684 49.3249 47.6692 45.8228 44.7733 45.9370 47.2127 49.1951 51.4869 53.3405 (42a)
Hot water usage for baths
23.1496 22.8058 22.3217 21.4290 20.7606 20.0194 19.6190 20.0998 20.6232 21.4163 22.3274 23.0714 (42b)
Hot water usage for other uses
32.5422 31.3589 30.1755 28.9922 27.8088 26.6255 26.6255 27.8088 28.9922 30.1755 31.3589 32.5422 (42c)
Average daily hot water use (litres/day) 100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m													
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
										Total per year (kWh/year) = Sum(64)m =		2012.0777	(64)
12Total per year (kWh/year)												2012	(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													
	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains													
	411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917	(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	
Northeast	8.0200	11.2829	0.6300	0.7000	0.7700	27.6547	(75)
Southwest	3.0900	36.7938	0.6300	0.7000	0.7700	34.7460	(79)

Solar gains	62.4007	115.4773	182.4001	266.8990	336.2776	350.2654	330.8601	276.5903	211.2662	134.2056	76.4145	52.3196	(83)
Total gains	473.5948	534.5094	585.3531	655.5111	706.4527	704.5479	672.5380	619.4227	563.8593	501.7005	465.2615	455.7113	(84)

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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	70.5969	70.7848	70.9701	71.8532	72.0208	72.8118	72.8118	72.9602	72.5051	72.0208	71.6824	71.3321	
alpha	5.7065	5.7190	5.7313	5.7902	5.8014	5.8541	5.8541	5.8640	5.8337	5.8014	5.7788	5.7555	
util living area													
	0.9843	0.9683	0.9305	0.8189	0.6386	0.4482	0.3242	0.3669	0.5958	0.8689	0.9663	0.9870	(86)
MIT	20.1750	20.3539	20.5891	20.8479	20.9677	20.9965	20.9996	20.9991	20.9835	20.8175	20.4656	20.1466	(87)
Th 2	20.0970	20.0991	20.1013	20.1114	20.1133	20.1221	20.1221	20.1237	20.1187	20.1133	20.1094	20.1054	(88)
util rest of house													
	0.9798	0.9597	0.9127	0.7813	0.5847	0.3878	0.2597	0.2974	0.5253	0.8306	0.9556	0.9832	(89)
MIT 2	19.1586	19.3829	19.6703	19.9710	20.0892	20.1202	20.1219	20.1234	20.1089	19.9482	19.5329	19.1294	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	19.6345	19.8376	20.1005	20.3816	20.5006	20.5306	20.5329	20.5335	20.5184	20.3553	19.9696	19.6057	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6345	19.8376	20.1005	20.3816	20.5006	20.5306	20.5329	20.5335	20.5184	20.3553	19.9696	19.6057	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9567	0.9126	0.7933	0.6087	0.4160	0.2899	0.3299	0.5578	0.8419	0.9536	0.9806	(94)
Useful gains	462.6820	511.3780	534.2158	520.0407	429.9998	293.0938	194.9537	204.3764	314.5111	422.3972	443.6737	446.8785	(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													
	784.3795	762.0455	692.0252	577.0292	441.2584	294.1266	195.0524	204.5833	319.6695	489.1280	648.3278	779.8975	(97)
Space heating kWh													
	239.3429	168.4485	117.4102	41.0317	8.3764	0.0000	0.0000	0.0000	0.0000	49.6477	147.3509	247.7661	(98a)
Space heating requirement - total per year (kWh/year)												1019.3745	
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													
	239.3429	168.4485	117.4102	41.0317	8.3764	0.0000	0.0000	0.0000	0.0000	49.6477	147.3509	247.7661	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1019.3745	
Space heating per m2											(98c) / (4) =	19.6034	(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													
	239.3429	168.4485	117.4102	41.0317	8.3764	0.0000	0.0000	0.0000	0.0000	49.6477	147.3509	247.7661	(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)													
	259.3097	182.5011	127.2050	44.4547	9.0752	0.0000	0.0000	0.0000	0.0000	53.7895	159.6435	268.4357	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.4966	83.9815	83.0594	81.4458	80.2029	79.8000	79.8000	79.8000	79.8000	81.6970	83.6624	84.5966	(217)
Fuel for water heating, kWh/month													
	233.2387	207.7081	223.7278	202.2959	200.2586	182.6008	181.2006	187.7579	189.0926	204.4869	210.5350	230.6504	(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	16.0007	12.8364	11.5577	8.4677	6.5407	5.3438	5.9666	7.7557	10.0738	13.2174	14.9290	16.4454	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.0683	-20.9172	-31.6975	-37.6496	-42.3904	-40.2476	-39.7772	-36.6675	-31.4861	-24.8082	-15.8531	-12.0411	(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	-4.9663	-10.6863	-21.6856	-33.2268	-44.5711	-44.9977	-44.4484	-37.3257	-26.9695	-15.4746	-6.6935	-3.9083	(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												1104.4144	(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	2453.5534 (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)	129.1350 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-642.5576 (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	3130.5452 (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	1104.4144	0.2100	231.9270	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2453.5534	0.2100	515.2462	(264)
Space and water heating			747.1732	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.1350	0.1443	18.6382	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	0.1335	-46.3925	
PV Unit electricity exported	-294.9537	0.1253	-36.9657	
Total			-83.3582	(269)
Total CO2, kg/year			694.3824	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.3500	(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	1104.4144	1.1300	1247.9882	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2453.5534	1.1300	2772.5153	(278)
Space and water heating			4020.5035	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.1350	1.5338	198.0716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	1.4932	-519.0405	
PV Unit electricity exported	-294.9537	0.4600	-135.6819	
Total			-654.7223	(283)
Total Primary energy kWh/year			3693.9536	(286)
Target Primary Energy Rate (TPER)			71.0400	(287)

Full SAP Calculation Printout

Property Reference	2.F Flat - 39-41 OS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	80 C	DER	4.52	TER	13.69
Environmental	97 A	% DER < TER			66.98
CO_2 Emissions (t/year)	0.21	DFEE	55.54	TFEE	30.35
Compliance Check	See BREL	% DFEE < TFEE			-82.98
% DPER < TPER	34.50	DPER	47.71	TPER	72.84

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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		53.0000 (1b)	x	2.4800 (2b)	=	131.4400 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.4400 (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		10.0000	(17)
Infiltration rate		0.5000	(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) =	0.3875	(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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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 = 1.60)			10.8900	1.5038	16.3759			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
External Wall 1	49.7000	12.7800	36.9200	0.2100	7.7532			(29a)

Sheltered Wall	15.8200	15.8200	0.2100	3.3222	(29a)
Total net area of external elements Aum(A, m2)		65.5200			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		33.1213	(33)
Party Wall 1		22.7900	0.0000	0.0000	(32)
Party Floor 1		53.0000			(32d)
Party Ceiling 1		53.0000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		13.1040 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.2253 (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	24.7700	24.3498	23.9296	21.8286	21.4084	19.3074	19.3074	18.8872	20.1478	21.4084	22.2488	23.0892	(38)
Heat transfer coeff	70.9953	70.5751	70.1549	68.0539	67.6337	65.5327	65.5327	65.1125	66.3731	67.6337	68.4741	69.3145	(39)
Average = Sum(39)m / 12 =												67.9489	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3395	1.3316	1.3237	1.2840	1.2761	1.2365	1.2365	1.2285	1.2523	1.2761	1.2920	1.3078	(40)
HLP (average)												1.2821	
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												1.7786 (42)
Hot water usage for mixer showers	54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331 (42a)
Hot water usage for baths	23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833 (42b)
Hot water usage for other uses	32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442 (42c)
Average daily hot water use (litres/day)												101.3421 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)										Total = Sum(45)m =		1683.2709	
Distribution loss (46)m = 0.15 x (45)m	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(64)
										Total per year (kWh/year) = Sum(64)m =		2421.2279	(64)
12Total per year (kWh/year)												2421	(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	108.1964	96.3731	103.8136	94.3446	93.6158	86.6776	87.0797	89.1342	88.5900	96.0358	98.8047	107.3877	(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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.5370	86.9517	78.5370	81.1549	78.5370	81.1549	78.5370	78.5370	81.1549	78.5370	81.1549	78.5370	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	145.4252	143.4124	139.5344	131.0341	125.8277	120.3855	117.0426	119.8040	123.0417	129.0803	137.2288	144.3384	(72)
Total internal gains	428.6584	436.6689	420.3226	405.8105	387.0928	374.0302	361.2296	362.3825	372.2916	384.3420	406.0018	420.7318	(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	9.2400	10.6334	0.6400	0.7000	0.7700	30.5039 (74)
Southeast	1.6500	36.7938	0.6400	0.7000	0.7700	18.8482 (77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	49.3521	90.4000	142.9847	213.5393	275.3011	289.9773	272.5756	223.4349	166.6629	104.8754	60.2063	41.5597	(83)
Total gains	478.0105	527.0688	563.3072	619.3498	662.3939	664.0076	633.8052	585.8174	538.9546	489.2174	466.2081	462.2914	(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	51.8422	52.1509	52.4633	54.0829	54.4189	56.1636	56.1636	56.5261	55.4525	54.4189	53.7511	53.0994	
alpha	4.4561	4.4767	4.4976	4.6055	4.6279	4.7442	4.7442	4.7684	4.6968	4.6279	4.5834	4.5400	
util living area	0.9895	0.9825	0.9675	0.9163	0.8004	0.6033	0.4490	0.5009	0.7514	0.9348	0.9803	0.9909	(86)
MIT	19.6067	19.7893	20.0741	20.4947	20.8046	20.9625	20.9925	20.9878	20.8948	20.5135	20.0245	19.6111	(87)
Th 2	19.8100	19.8162	19.8223	19.8534	19.8596	19.8909	19.8909	19.8972	19.8784	19.8596	19.8471	19.8347	(88)
util rest of house	0.9861	0.9769	0.9566	0.8885	0.7401	0.5105	0.3389	0.3861	0.6631	0.9071	0.9729	0.9879	(89)
MIT 2	18.2301	18.4650	18.8266	19.3590	19.7033	19.8711	19.8887	19.8933	19.8118	19.3966	18.7864	18.2529	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	18.9462	19.1539	19.4755	19.9497	20.2762	20.4388	20.4629	20.4627	20.3751	19.9776	19.4304	18.9594	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9462	19.1539	19.4755	19.9497	20.2762	20.4388	20.4629	20.4627	20.3751	19.9776	19.4304	18.9594	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9828	0.9729	0.9526	0.8912	0.7638	0.5576	0.3963	0.4459	0.7048	0.9105	0.9695	0.9849	(94)
Useful gains	469.8006	512.7596	536.6005	551.9362	505.9166	370.2500	251.1812	261.2218	379.8592	445.4148	451.9659	455.3257	(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	1039.8119	1005.9704	910.2979	751.9779	580.0393	382.6347	253.1454	264.5299	416.5009	634.2408	844.3149	1023.0416	(97)
Space heating kWh	424.0884	331.4377	278.0308	144.0301	55.1472	0.0000	0.0000	0.0000	0.0000	140.4866	282.4913	422.3806	(98a)
Space heating requirement - total per year (kWh/year)												2078.0926	
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	424.0884	331.4377	278.0308	144.0301	55.1472	0.0000	0.0000	0.0000	0.0000	140.4866	282.4913	422.3806	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2078.0926	
Space heating per m2										(98c) / (4) =		39.2093	(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	616.0076	484.9422	494.8552	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8886	0.9381	0.9150	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	547.3554	454.9240	452.8155	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	731.3305	697.8974	642.6638	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	132.4621	180.7723	141.2472	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.1155	45.1931	35.3118	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												113.6204	(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 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 1.0000 (306)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating:
Space heating requirement
424.0884 331.4377 278.0308 144.0301 55.1472 0.0000 0.0000 0.0000 0.0000 140.4866 282.4913 422.3806 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00
307a 424.0884 331.4377 278.0308 144.0301 55.1472 0.0000 0.0000 0.0000 0.0000 140.4866 282.4913 422.3806
Space heating requirement
424.0884 331.4377 278.0308 144.0301 55.1472 0.0000 0.0000 0.0000 0.0000 140.4866 282.4913 422.3806 (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
237.2795 210.2489 224.0982 198.4626 193.4281 175.4040 173.7708 179.9497 181.1557 200.7062 211.8766 234.8475 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00
310a 237.2795 210.2489 224.0982 198.4626 193.4281 175.4040 173.7708 179.9497 181.1557 200.7062 211.8766 234.8475
Water heating fuel
237.2795 210.2489 224.0982 198.4626 193.4281 175.4040 173.7708 179.9497 181.1557 200.7062 211.8766 234.8475 (310)
Cooling System Energy Efficiency Ratio 4.3000 (314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 7.7013 10.5100 8.2120 0.0000 0.0000 0.0000 0.0000 (315)
Pumps and Fa 14.3548 12.9656 14.3548 13.8917 14.3548 13.8917 14.3548 14.3548 13.8917 14.3548 13.8917 14.3548 (331)
Lighting 14.4284 11.5750 10.4220 7.6356 5.8979 4.8187 5.3803 6.9935 9.0839 11.9186 13.4620 14.8294 (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 2078.0926 (307)
Space heating fuel - secondary 0.0000 (309)
Water heating fuel - community heating 2421.2279 (310)
Efficiency of water heater 0.0000 (311)
Electricity used for heat distribution 20.7809 (313)
Space cooling fuel 26.4233 (321)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 169.0161 (330a)
Total electricity for the above, kWh/year 169.0161 (331)
Electricity for lighting (calculated in Appendix L) 116.4452 (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 4811.2052 (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			350.0000	(367)
Space and Water heating from Heat pump	1285.5202	0.1555	92.3375	(367)
Electrical energy for heat distribution (space & water)	20.7809	0.0000	6.6386	(372)
Overall CO2 factor for heat network			0.0436	(386)
Total CO2 associated with community systems			196.3127	(373)
Space and water heating			196.3127	(376)
Space cooling	26.4233	0.1139	3.0105	(377)
Pumps, fans and electric keep-hot	169.0161	0.1387	23.4446	(378)
Energy for lighting	116.4452	0.1443	16.8066	(379)
Total CO2, kg/year			239.5745	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5200	(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			350.0000	(467a)
Space and Water heating from Heat pump	1285.5202	1.5758	935.6011	(467)
Electrical energy for heat distribution (space & water)	20.7809	0.0000	69.5551	(472)
Overall CO2 factor for heat network			0.4571	(486)
Total CO2 associated with community systems			2056.8444	(473)
Space and water heating			2056.8444	(476)
Space cooling	26.4233	1.4200	37.5203	(477)
Pumps, fans and electric keep-hot	169.0161	1.5128	255.6875	(478)
Energy for lighting	116.4452	1.5338	178.6076	(479)

Total Primary energy kWh/year 2528.6597 (483)
Dwelling Primary energy Rate (DPER) 47.7100 (484)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		53.0000 (1b)	x	2.4800 (2b)	=	131.4400 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.4400 (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			2 * 10 =	20.0000 (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) =			20.0000 / (5) =	0.1522 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				5.0000 (17)
Infiltration rate				0.4022 (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) =	0.3117 (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	0.3974	0.3896	0.3818	0.3428	0.3351	0.2961	0.2961	0.2883	0.3117	0.3351	0.3506	0.3662	(22b)
Effective ac	0.5790	0.5759	0.5729	0.5588	0.5561	0.5438	0.5438	0.5416	0.5486	0.5561	0.5615	0.5671	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			10.8900	1.1450	12.4695			(27)
External Wall 1	49.7000	12.7800	36.9200	0.1800	6.6456			(29a)
Sheltered Wall	15.8200		15.8200	0.1800	2.8476			(29a)
Total net area of external elements Aum(A, m2)			65.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.8527			(33)
Party Wall 1			22.7900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							3.2760	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		27.1287	(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	25.1124	24.9794	24.8490	24.2368	24.1222	23.5889	23.5889	23.4902	23.7944	24.1222	24.3540	24.5962	(38)
Heat transfer coeff	52.2411	52.1081	51.9777	51.3654	51.2509	50.7176	50.7176	50.6189	50.9230	51.2509	51.4826	51.7249	(39)
Average = Sum(39)m / 12 =												51.3649	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9857	0.9832	0.9807	0.9692	0.9670	0.9569	0.9569	0.9551	0.9608	0.9670	0.9714	0.9759	(40)
HLP (average)												0.9691	
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 1.7786 (42)

Hot water usage for mixer showers

54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331 (42a)

Hot water usage for baths

23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833 (42b)

Hot water usage for other uses

32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442 (42c)

Average daily hot water use (litres/day) 101.3421 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)										Total = Sum(45)m =		1683.2709	
Distribution loss (46)m = 0.15 x (45)m													
	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	223.1557	197.4919	209.9744	184.7945	179.3044	161.7358	159.6470	165.8259	167.4875	186.5825	198.2084	220.7238	(62)
WWHRS	-24.7049	-21.8492	-22.8792	-18.9449	-17.6560	-15.1083	-14.1617	-15.0595	-15.6317	-18.4280	-20.8767	-24.2474	(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													
	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3843	(64)
12Total per year (kWh/year)												2025	(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													
	96.8974	86.1676	92.5146	83.4100	82.3168	75.7430	75.7807	77.8352	77.6555	84.7367	87.8702	96.0887	(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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	78.5370	86.9517	78.5370	81.1549	78.5370	81.1549	78.5370	78.5370	81.1549	78.5370	81.1549	78.5370	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)													
	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)													
	130.2384	128.2255	124.3475	115.8473	110.6408	105.1987	101.8558	104.6172	107.8548	113.8935	122.0419	129.1515	(72)
Total internal gains													
	416.4716	424.4820	408.1357	393.6237	374.9059	358.8434	346.0428	347.1956	357.1048	372.1552	393.8149	408.5449	(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	9.2400	10.6334	0.6300	0.7000	0.7700	30.0273	(74)
Southeast	1.6500	36.7938	0.6300	0.7000	0.7700	18.5537	(77)

Solar gains	48.5810	88.9875	140.7505	210.2027	270.9996	285.4464	268.3166	219.9437	164.0588	103.2367	59.2656	40.9103	(83)
Total gains	465.0525	513.4695	548.8862	603.8264	645.9055	644.2898	614.3594	567.1393	521.1636	475.3919	453.0805	449.4552	(84)

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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	70.4533	70.6331	70.8103	71.6543	71.8145	72.5696	72.5696	72.7112	72.2768	71.8145	71.4912	71.1564	
alpha	5.6969	5.7089	5.7207	5.7770	5.7876	5.8380	5.8380	5.8474	5.8185	5.7876	5.7661	5.7438	
util living area													
	0.9868	0.9756	0.9497	0.8645	0.6998	0.4992	0.3626	0.4092	0.6504	0.8968	0.9725	0.9889	(86)
MIT	20.1379	20.2949	20.5150	20.7918	20.9484	20.9938	20.9992	20.9984	20.9740	20.7767	20.4251	20.1133	(87)
Th 2	20.0953	20.0974	20.0994	20.1091	20.1109	20.1194	20.1194	20.1209	20.1161	20.1109	20.1073	20.1034	(88)
util rest of house													
	0.9830	0.9686	0.9357	0.8314	0.6445	0.4326	0.2904	0.3318	0.5765	0.8631	0.9634	0.9857	(89)
MIT 2	19.1107	19.3090	19.5818	19.9112	20.0713	20.1161	20.1191	20.1204	20.1003	19.9039	19.4818	19.0860	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.6450	19.8219	20.0673	20.3693	20.5276	20.5726	20.5769	20.5771	20.5548	20.3579	19.9725	19.6204	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6450	19.8219	20.0673	20.3693	20.5276	20.5726	20.5769	20.5771	20.5548	20.3579	19.9725	19.6204	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9806	0.9661	0.9351	0.8417	0.6711	0.4671	0.3280	0.3721	0.6140	0.8734	0.9618	0.9835	(94)
Useful gains	456.0386	496.0750	513.2608	508.2607	433.4679	300.9481	201.4969	211.0274	320.0159	415.1975	435.7614	442.0246	(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													
	801.6397	777.5493	705.1956	589.1259	452.4214	302.9185	201.7002	211.4419	328.6978	500.1027	662.7090	797.6183	(97)
Space heating kWh													
	257.1272	189.1507	142.7995	58.2229	14.1014	0.0000	0.0000	0.0000	0.0000	63.1694	163.4022	264.5617	(98a)
Space heating requirement - total per year (kWh/year)												1152.5350	
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													
	257.1272	189.1507	142.7995	58.2229	14.1014	0.0000	0.0000	0.0000	0.0000	63.1694	163.4022	264.5617	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1152.5350	
Space heating per m2											(98c) / (4) =	21.7459	(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													
	257.1272	189.1507	142.7995	58.2229	14.1014	0.0000	0.0000	0.0000	0.0000	63.1694	163.4022	264.5617	(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)													
	278.5777	204.9303	154.7123	63.0801	15.2777	0.0000	0.0000	0.0000	0.0000	68.4393	177.0338	286.6324	(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													
	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.6417	84.2263	83.4616	81.9584	80.4543	79.8000	79.8000	79.8000	79.8000	82.0715	83.8767	84.7277	(217)
Fuel for water heating, kWh/month													
	234.4599	208.5368	224.1693	202.3583	200.9196	183.7437	182.3124	188.9303	190.2955	204.8878	211.4194	231.8915	(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	16.3184	13.0913	11.7872	8.6358	6.6706	5.4499	6.0851	7.9097	10.2739	13.4799	15.2255	16.7720	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3310	-21.3036	-32.2760	-38.3272	-43.1436	-40.9579	-40.4780	-37.3177	-32.0514	-25.2615	-16.1474	-12.2665	(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	-5.0696	-10.9077	-22.1337	-33.9122	-45.4902	-45.9268	-45.3673	-38.0984	-27.5284	-15.7960	-6.8329	-3.9897	(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												1248.6837	(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	2463.9245 (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)	131.6991 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-654.9144 (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	3275.3929 (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	1248.6837	0.2100	262.2236	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2463.9245	0.2100	517.4241	(264)
Space and water heating			779.6477	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	131.6991	0.1443	19.0083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-353.8617	0.1335	-47.2296	
PV Unit electricity exported	-301.0527	0.1253	-37.7302	
Total			-84.9598	(269)
Total CO2, kg/year			725.6255	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6900	(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	1248.6837	1.1300	1411.0126	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2463.9245	1.1300	2784.2347	(278)
Space and water heating			4195.2472	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	131.6991	1.5338	202.0045	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-353.8617	1.4932	-528.3918	
PV Unit electricity exported	-301.0527	0.4600	-138.4878	
Total			-666.8795	(283)
Total Primary energy kWh/year			3860.4730	(286)
Target Primary Energy Rate (TPER)			72.8400	(287)

Full SAP Calculation Printout

Property Reference	3.F Flat - 10-12 MS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	78 C	DER	5.07	TER	14.34
Environmental	96 A	% DER < TER			64.64
CO_2 Emissions (t/year)	0.23	DFEE	67.46	TFEE	33.20
Compliance Check	See BREL	% DFEE < TFEE			-103.23
% DPER < TPER	30.13	DPER	53.36	TPER	76.36

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 2.4600	(2b) =	127.9200	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		127.9200	(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		10.0000	(17)
Infiltration rate		0.5000	(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) =	0.3875	(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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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 = 1.50)			11.5800	1.4151	16.3868			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
External Wall 1	46.3500	13.4700	32.8800	0.3000	9.8640			(29a)

External Roof 1	52.0000	52.0000	0.1600	8.3200	(30)
Total net area of external elements Aum(A, m2)		98.3500			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		40.2408	(33)
Party Wall 1		30.4800	0.0000	0.0000	(32)
Party Floor 1		52.0000			(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		19.6700 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.9108 (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	24.1066	23.6977	23.2887	21.2440	20.8351	18.7903	18.7903	18.3814	19.6082	20.8351	21.6529	22.4708	(38)
Heat transfer coeff	84.0174	83.6085	83.1995	81.1548	80.7458	78.7011	78.7011	78.2922	79.5190	80.7458	81.5637	82.3816	(39)

Average = Sum(39)m / 12 = 81.0526

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6157	1.6079	1.6000	1.5607	1.5528	1.5135	1.5135	1.5056	1.5292	1.5528	1.5685	1.5843	(40)
HLP (average)												1.5587	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491	(42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405	(42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714	(42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422	(42c)
Average daily hot water use (litres/day)												100.4145	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
										Total per year (kWh/year) = Sum(64)m =		2405.8210	(64)
12Total per year (kWh/year)												2406	(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	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8832	85.1207	76.8832	79.4460	76.8832	79.4460	76.8832	76.8832	79.4460	76.8832	79.4460	76.8832	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2562	431.0810	415.0152	400.6701	382.2373	369.3406	356.7401	357.8945	367.6511	379.5571	400.9050	415.4538	(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
Northeast	8.1100	11.2829	0.6200	0.7000	0.7700	27.5211 (75)
Southwest	3.4700	36.7938	0.6200	0.7000	0.7700	38.3997 (79)

Solar gains	65.9208	121.4289	190.4255	276.6455	347.0142	360.8450	341.0930	286.0967	219.8896	140.7516	80.6226	55.3372 (83)
Total gains	489.1770	552.5099	605.4407	677.3156	729.2514	730.1856	697.8331	643.9912	587.5407	520.3087	481.5277	470.7911 (84)

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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	42.9805	43.1907	43.4030	44.4966	44.7219	45.8839	45.8839	46.1235	45.4119	44.7219	44.2735	43.8339	
alpha	3.8654	3.8794	3.8935	3.9664	3.9815	4.0589	4.0589	4.0749	4.0275	3.9815	3.9516	3.9223	
util living area													
	0.9888	0.9811	0.9648	0.9155	0.8108	0.6339	0.4813	0.5349	0.7728	0.9377	0.9802	0.9903	(86)
MIT	19.2529	19.4701	19.8144	20.3059	20.6934	20.9210	20.9798	20.9696	20.8175	20.3242	19.7325	19.2467	(87)
Th 2	19.6018	19.6076	19.6133	19.6423	19.6481	19.6774	19.6774	19.6833	19.6657	19.6481	19.6365	19.6249	(88)
util rest of house													
	0.9851	0.9748	0.9524	0.8853	0.7453	0.5247	0.3440	0.3934	0.6751	0.9087	0.9723	0.9871	(89)
MIT 2	17.6420	17.9201	18.3557	18.9724	19.4059	19.6366	19.6720	19.6741	19.5520	19.0127	18.2741	17.6491	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	18.3963	18.6459	19.0387	19.5969	20.0088	20.2381	20.2844	20.2808	20.1446	19.6269	18.9570	18.3972	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3963	18.6459	19.0387	19.5969	20.0088	20.2381	20.2844	20.2808	20.1446	19.6269	18.9570	18.3972	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9805	0.9688	0.9458	0.8841	0.7646	0.5734	0.4086	0.4599	0.7138	0.9081	0.9670	0.9830	(94)
Useful gains	479.6346	535.2871	572.6083	598.7996	557.6056	418.6522	285.1127	296.1468	419.3775	472.4846	465.6553	462.7742	(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													
	1184.3367	1149.2775	1043.2173	868.1030	670.8979	443.7216	289.9675	303.8333	480.6601	728.8820	967.0996	1169.5878	(97)
Space heating kWh													
	524.2984	412.6016	350.1331	193.8984	84.2895	0.0000	0.0000	0.0000	0.0000	190.7596	361.0399	525.8693	(98a)
Space heating requirement - total per year (kWh/year)												2642.8898	
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													
	524.2984	412.6016	350.1331	193.8984	84.2895	0.0000	0.0000	0.0000	0.0000	190.7596	361.0399	525.8693	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2642.8898	
Space heating per m2											(98c) / (4) =	50.8248	(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	739.7905	582.3883	595.0205	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8368	0.8976	0.8676	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	619.0520	522.7529	516.2185	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	809.6971	773.7086	711.6068	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	137.2645	186.7110	145.3689	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.3161	46.6778	36.3422	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												117.3361	(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 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	1.0000	(306)

Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
	524.2984	412.6016	350.1331	193.8984	84.2895	0.0000	0.0000	0.0000	0.0000	190.7596	361.0399	525.8693 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	524.2984	412.6016	350.1331	193.8984	84.2895	0.0000	0.0000	0.0000	0.0000	190.7596	361.0399	525.8693
Space heating requirement												
	524.2984	412.6016	350.1331	193.8984	84.2895	0.0000	0.0000	0.0000	0.0000	190.7596	361.0399	525.8693 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												4.3000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	7.9805	10.8553	8.4517	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.9704	12.6184	13.9704	13.5197	13.9704	13.5197	13.9704	13.9704	13.5197	13.9704	13.5197	13.9704 (331)
Lighting	14.1245	11.3312	10.2025	7.4748	5.7738	4.7172	5.2670	6.8463	8.8926	11.6676	13.1785	14.5171 (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												2642.8898 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												26.4289 (313)
Space cooling fuel												27.2875 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)												
mechanical ventilation fans (SFP = 1.0540)												164.4898 (330a)
Total electricity for the above, kWh/year												164.4898 (331)
Electricity for lighting (calculated in Appendix L)												113.9932 (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												5354.4812 (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			350.0000	(367)
Space and Water heating from Heat pump	1442.4888	0.1552	117.1651	(367)
Electrical energy for heat distribution (space & water)	26.4289	0.0000	7.4857	(372)
Overall CO2 factor for heat network			0.0438	(386)
Total CO2 associated with community systems			221.3642	(373)
Space and water heating			221.3642	(376)
Space cooling	27.2875	0.1139	3.1092	(377)
Pumps, fans and electric keep-hot	164.4898	0.1387	22.8168	(378)
Energy for lighting	113.9932	0.1443	16.4527	(379)
Total CO2, kg/year			263.7429	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0700	(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			350.0000	(467a)
Space and Water heating from Heat pump	1442.4888	1.5745	1188.8883	(467)
Electrical energy for heat distribution (space & water)	26.4289	0.0000	78.1854	(472)
Overall CO2 factor for heat network			0.4579	(486)
Total CO2 associated with community systems			2312.0553	(473)
Space and water heating			2312.0553	(476)
Space cooling	27.2875	1.4200	38.7481	(477)
Pumps, fans and electric keep-hot	164.4898	1.5128	248.8401	(478)
Energy for lighting	113.9932	1.5338	174.8466	(479)
Total Primary energy kWh/year			2774.4901	(483)

Dwelling Primary energy Rate (DPER) 53.3600 (484)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.4600 (2b)	=	127.9200 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.9200 (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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1563	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4063	(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) =	0.3149	(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	0.4015	0.3936	0.3858	0.3464	0.3385	0.2992	0.2992	0.2913	0.3149	0.3385	0.3543	0.3700	(22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
External Wall 1	46.3500	13.0000	33.3500	0.1800	6.0030			(29a)
External Roof 1	52.0000		52.0000	0.1100	5.7200			(30)
Total net area of external elements Aum(A, m2)			98.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3344			(33)
Party Wall 1			30.4800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	4.9175	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	31.2519	(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	24.5096	24.3775	24.2480	23.6396	23.5258	22.9960	22.9960	22.8978	23.2001	23.5258	23.7561	23.9968	(38)
Heat transfer coeff	55.7615	55.6294	55.4999	54.8915	54.7777	54.2478	54.2478	54.1497	54.4519	54.7777	55.0079	55.2487	(39)
Average = Sum(39)m / 12 =												54.8910	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0723	1.0698	1.0673	1.0556	1.0534	1.0432	1.0432	1.0413	1.0472	1.0534	1.0578	1.0625	(40)
HLP (average)												1.0556	
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 1.7491 (42)

Hot water usage for mixer showers

53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)

Hot water usage for baths

23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)

Hot water usage for other uses

32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)

Average daily hot water use (litres/day) 100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)

Energy content (annual) Total = Sum(45)m = 1667.8640

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

25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)

Water storage loss:

Store volume 172.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5107 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8158 (55)

Total storage loss

25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)

If cylinder contains dedicated solar storage

25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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

221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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

197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)

Total per year (kWh/year) = Sum(64)m = 2012.0777 (64)

12Total per year (kWh/year) 2012 (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

96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)

-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)

Water heating gains (Table 5)

129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)

Total internal gains

411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917	(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	
Northeast	7.7800	11.2829	0.6300	0.7000	0.7700	26.8271	(75)
Southwest	3.3300	36.7938	0.6300	0.7000	0.7700	37.4448	(79)

Solar gains	64.2719	118.3896	185.6548	269.7079	338.3067	351.7884	332.5330	278.9201	214.3784	137.2275	78.6056	53.9533	(83)
Total gains	475.4659	537.4218	588.6078	658.3200	708.4818	706.0710	674.2109	621.7524	566.9715	504.7224	467.4526	457.3450	(84)

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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	64.7599	64.9137	65.0652	65.7863	65.9230	66.5669	66.5669	66.6875	66.3174	65.9230	65.6471	65.3611	
alpha	5.3173	5.3276	5.3377	5.3858	5.3949	5.4378	5.4378	5.4458	5.4212	5.3949	5.3765	5.3574	
util living area													
	0.9861	0.9726	0.9413	0.8471	0.6803	0.4864	0.3532	0.3990	0.6368	0.8899	0.9712	0.9884	(86)
MIT	20.0332	20.2198	20.4753	20.7766	20.9423	20.9921	20.9989	20.9978	20.9692	20.7471	20.3487	20.0026	(87)
Th 2	20.0235	20.0256	20.0276	20.0373	20.0391	20.0475	20.0475	20.0490	20.0442	20.0391	20.0354	20.0316	(88)
util rest of house													
	0.9819	0.9648	0.9250	0.8106	0.6219	0.4164	0.2772	0.3174	0.5588	0.8536	0.9615	0.9850	(89)
MIT 2	18.9237	19.1587	19.4736	19.8281	19.9955	20.0434	20.0471	20.0483	20.0258	19.8069	19.3303	18.8913	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	19.4432	19.6556	19.9427	20.2722	20.4389	20.4876	20.4928	20.4929	20.4676	20.2472	19.8072	19.4117	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4432	19.6556	19.9427	20.2722	20.4389	20.4876	20.4928	20.4929	20.4676	20.2472	19.8072	19.4117	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9612	0.9234	0.8201	0.6469	0.4490	0.3128	0.3556	0.5943	0.8623	0.9587	0.9821	(94)
Useful gains	465.3989	516.5600	543.5210	539.9173	458.3059	317.0366	210.9123	221.1131	336.9449	435.2388	448.1700	449.1700	(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													
	844.4085	820.8428	746.0660	624.2386	478.6946	319.3917	211.1754	221.6320	346.7258	528.4495	698.9959	840.4244	(97)
Space heating kWh													
	281.9831	204.4780	150.6935	60.7113	15.1692	0.0000	0.0000	0.0000	0.0000	69.3487	180.5947	291.0933	(98a)
Space heating requirement - total per year (kWh/year)												1254.0719	
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													
	281.9831	204.4780	150.6935	60.7113	15.1692	0.0000	0.0000	0.0000	0.0000	69.3487	180.5947	291.0933	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1254.0719	
Space heating per m2											(98c) / (4) =	24.1168	(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													
	281.9831	204.4780	150.6935	60.7113	15.1692	0.0000	0.0000	0.0000	0.0000	69.3487	180.5947	291.0933	(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)													
	305.5071	221.5363	163.2649	65.7761	16.4347	0.0000	0.0000	0.0000	0.0000	75.1341	195.6605	315.3774	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.8626	84.4171	83.5939	82.0388	80.5041	79.8000	79.8000	79.8000	79.8000	82.2452	84.1159	84.9549	(217)
Fuel for water heating, kWh/month													
	232.2326	206.6365	222.2974	200.8336	199.5093	182.6008	181.2006	187.7579	189.0926	203.1238	209.3999	229.6775	(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	16.0007	12.8364	11.5577	8.4677	6.5407	5.3438	5.9666	7.7557	10.0738	13.2174	14.9290	16.4454	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.0683	-20.9172	-31.6975	-37.6496	-42.3904	-40.2476	-39.7772	-36.6675	-31.4861	-24.8082	-15.8531	-12.0411	(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	-4.9663	-10.6863	-21.6856	-33.2268	-44.5711	-44.9977	-44.4484	-37.3257	-26.9695	-15.4746	-6.6935	-3.9083	(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												1358.6911	(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	2444.3625 (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)	129.1350 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-642.5576 (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	3375.6311 (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	1358.6911	0.2100	285.3251	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2444.3625	0.2100	513.3161	(264)
Space and water heating			798.6413	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.1350	0.1443	18.6382	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	0.1335	-46.3925	
PV Unit electricity exported	-294.9537	0.1253	-36.9657	
Total			-83.3582	(269)
Total CO2, kg/year			745.8505	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.3400	(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	1358.6911	1.1300	1535.3210	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2444.3625	1.1300	2762.1297	(278)
Space and water heating			4297.4506	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.1350	1.5338	198.0716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-347.6038	1.4932	-519.0405	
PV Unit electricity exported	-294.9537	0.4600	-135.6819	
Total			-654.7223	(283)
Total Primary energy kWh/year			3970.9007	(286)
Target Primary Energy Rate (TPER)			76.3600	(287)

Full SAP Calculation Printout

Property Reference	3.F Flat - 39-41 OS Green	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	Flat - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	78 C	DER	5.03	TER	14.82
Environmental	96 A	% DER < TER			66.06
CO_2 Emissions (t/year)	0.23	DFEE	67.29	TFEE	35.27
Compliance Check	See BREL	% DFEE < TFEE			-90.80
% DPER < TPER	33.03	DPER	52.89	TPER	78.97

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	53.0000	(1b)	x 2.4000	(2b) =	127.2000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		127.2000	(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		10.0000	(17)
Infiltration rate		0.5000	(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) =	0.3875	(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	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553	(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) =	84.6000 (23c)

Effective ac	0.5711	0.5614	0.5517	0.5032	0.4936	0.4451	0.4451	0.4354	0.4645	0.4936	0.5129	0.5323	(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	
Windows (Uw = 1.60)			8.7100	1.5038	13.0977			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
External Wall 1	44.0900	10.6000	33.4900	0.2100	7.0329			(29a)

Sheltered Wall	14.0400	14.0400	0.2100	2.9484	(29a)
External Roof 1	53.0000	53.0000	0.1200	6.3600	(30)
Total net area of external elements Aum(A, m2)		111.1300			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		35.1090	(33)
Party Wall 1		20.2200	0.0000	0.0000	(32)
Party Floor 1		53.0000			(32d)
Party Ceiling 1		53.0000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area)		22.2260 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	57.3350 (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	23.9709	23.5643	23.1576	21.1244	20.7178	18.6846	18.6846	18.2779	19.4979	20.7178	21.5311	22.3444	(38)
Heat transfer coeff	81.3060	80.8993	80.4927	78.4595	78.0528	76.0196	76.0196	75.6130	76.8329	78.0528	78.8661	79.6794	(39)
Average = Sum(39)m / 12 =												78.3578	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5341	1.5264	1.5187	1.4804	1.4727	1.4343	1.4343	1.4267	1.4497	1.4727	1.4880	1.5034	(40)
HLP (average)												1.4784	
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												1.7786 (42)
Hot water usage for mixer showers	54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331 (42a)
Hot water usage for baths	23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833 (42b)
Hot water usage for other uses	32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442 (42c)
Average daily hot water use (litres/day)												101.3421 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)										Total = Sum(45)m =		1683.2709	
Distribution loss (46)m = 0.15 x (45)m	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(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	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475	(64)
										Total per year (kWh/year) = Sum(64)m =		2421.2279	(64)
12Total per year (kWh/year)												2421	(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	108.1964	96.3731	103.8136	94.3446	93.6158	86.6776	87.0797	89.1342	88.5900	96.0358	98.8047	107.3877	(65)

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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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.1502	89.8448	81.1502	83.8552	81.1502	83.8552	81.1502	81.1502	83.8552	81.1502	83.8552	81.1502	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	145.4252	143.4124	139.5344	131.0341	125.8277	120.3855	117.0426	119.8040	123.0417	129.0803	137.2288	144.3384	(72)
Total internal gains	431.2716	439.5620	422.9357	408.5108	389.7059	376.7305	363.8428	364.9956	374.9919	386.9552	408.7021	423.3449	(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	7.2200	10.6334	0.6400	0.7000	0.7700	23.8353 (74)
Southeast	1.4900	36.7938	0.6400	0.7000	0.7700	17.0205 (77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	40.8558	74.5427	117.0698	173.4775	222.5324	233.9465	220.0848	181.0938	136.0140	86.2644	49.7905	34.4363	(83)
Total gains	472.1274	514.1047	540.0055	581.9883	612.2383	610.6770	583.9276	546.0894	511.0059	473.2196	458.4926	457.7812	(84)

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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	45.2680	45.4955	45.7253	46.9103	47.1547	48.4159	48.4159	48.6762	47.9034	47.1547	46.6684	46.1921	
alpha	4.0179	4.0330	4.0484	4.1274	4.1436	4.2277	4.2277	4.2451	4.1936	4.1436	4.1112	4.0795	
util living area	0.9906	0.9856	0.9758	0.9441	0.8675	0.7076	0.5483	0.5993	0.8220	0.9525	0.9837	0.9917	(86)
MIT	19.3174	19.4938	19.7866	20.2371	20.6279	20.8953	20.9724	20.9605	20.7888	20.3103	19.7706	19.3190	(87)
Th 2	19.6620	19.6678	19.6735	19.7023	19.7080	19.7371	19.7371	19.7430	19.7255	19.7080	19.6965	19.6850	(88)
util rest of house	0.9874	0.9807	0.9670	0.9223	0.8138	0.6009	0.4029	0.4533	0.7346	0.9294	0.9771	0.9889	(89)
MIT 2	17.7631	17.9906	18.3646	18.9414	19.3972	19.6790	19.7291	19.7300	19.5856	19.0435	18.3630	17.7803	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	18.5716	18.7725	19.1043	19.6154	20.0374	20.3117	20.3759	20.3701	20.2115	19.7025	19.0952	18.5807	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5716	18.7725	19.1043	19.6154	20.0374	20.3117	20.3759	20.3701	20.2115	19.7025	19.0952	18.5807	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9763	0.9620	0.9205	0.8293	0.6526	0.4788	0.5293	0.7719	0.9293	0.9731	0.9856	(94)
Useful gains	464.4913	501.9091	519.4924	535.7224	507.7585	398.5333	279.6113	289.0459	394.4265	439.7415	446.1609	451.2084	(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	1160.3687	1122.2790	1014.5528	840.7258	650.7595	434.2039	287.0418	300.1879	469.5639	710.4745	946.0184	1145.8432	(97)
Space heating kWh	517.7328	416.8886	368.3250	219.6024	106.3928	0.0000	0.0000	0.0000	0.0000	201.4253	359.8974	516.8083	(98a)
Space heating requirement - total per year (kWh/year)												2707.0726	
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	517.7328	416.8886	368.3250	219.6024	106.3928	0.0000	0.0000	0.0000	0.0000	201.4253	359.8974	516.8083	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2707.0726	
Space heating per m2											(98c) / (4) =	51.0768	(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	714.5844	562.5451	574.6586	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7792	0.8552	0.8221	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	556.8289	481.1108	472.4433	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	666.0292	636.7491	593.4401	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	78.6243	115.7949	90.0216	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	19.6561	28.9487	22.5054	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												71.1102	(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 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												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
	517.7328	416.8886	368.3250	219.6024	106.3928	0.0000	0.0000	0.0000	0.0000	201.4253	359.8974	516.8083 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	517.7328	416.8886	368.3250	219.6024	106.3928	0.0000	0.0000	0.0000	0.0000	201.4253	359.8974	516.8083
Space heating requirement												
	517.7328	416.8886	368.3250	219.6024	106.3928	0.0000	0.0000	0.0000	0.0000	201.4253	359.8974	516.8083 (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												
	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475
Water heating fuel												
	237.2795	210.2489	224.0982	198.4626	193.4281	175.4040	173.7708	179.9497	181.1557	200.7062	211.8766	234.8475 (310)
Cooling System Energy Efficiency Ratio												4.3000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	4.5712	6.7323	5.2338	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.8917	12.5474	13.8917	13.4436	13.8917	13.4436	13.8917	13.8917	13.4436	13.8917	13.4436	13.8917 (331)
Lighting	14.9084	11.9601	10.7688	7.8897	6.0942	4.9790	5.5593	7.2262	9.3861	12.3151	13.9099	15.3228 (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												2707.0726 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2421.2279 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												27.0707 (313)
Space cooling fuel												16.5373 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)												
mechanical ventilation fans (SFP = 1.0540)												163.5639 (330a)
Total electricity for the above, kWh/year												163.5639 (331)
Electricity for lighting (calculated in Appendix L)												120.3197 (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												5428.7214 (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			350.0000	(367)
Space and Water heating from Heat pump	1465.2287	0.1547	119.6776	(367)
Electrical energy for heat distribution (space & water)	27.0707	0.0000	7.5955	(372)
Overall CO2 factor for heat network			0.0438	(386)
Total CO2 associated with community systems			224.6096	(373)
Space and water heating			224.6096	(376)
Space cooling	16.5373	0.1138	1.8820	(377)
Pumps, fans and electric keep-hot	163.5639	0.1387	22.6883	(378)
Energy for lighting	120.3197	0.1443	17.3659	(379)
Total CO2, kg/year			266.5458	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.0300	(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			350.0000	(467a)
Space and Water heating from Heat pump	1465.2287	1.5729	1216.5335	(467)
Electrical energy for heat distribution (space & water)	27.0707	0.0000	79.3878	(472)
Overall CO2 factor for heat network			0.4578	(486)
Total CO2 associated with community systems			2347.6094	(473)
Space and water heating			2347.6094	(476)
Space cooling	16.5373	1.4195	23.4749	(477)
Pumps, fans and electric keep-hot	163.5639	1.5128	247.4395	(478)

Energy for lighting	120.3197	1.5338	184.5504 (479)
Total Primary energy kWh/year			2803.0742 (483)
Dwelling Primary energy Rate (DPER)			52.8900 (484)

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

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1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			53.0000 (1b)	x	2.4000 (2b)	=	127.2000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	127.2000	(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		2 * 10 =	20.0000	(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) =		20.0000 / (5) =	0.1572	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.4072	(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) =	0.3156	(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	0.4024	0.3945	0.3866	0.3472	0.3393	0.2998	0.2998	0.2919	0.3156	0.3393	0.3551	0.3708	(22b)
Effective ac	0.5810	0.5778	0.5747	0.5603	0.5576	0.5449	0.5449	0.5426	0.5498	0.5576	0.5630	0.5688	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			8.7100	1.1450	9.9733			(27)
External Wall 1	44.0900	10.6000	33.4900	0.1800	6.0282			(29a)
Sheltered Wall	14.0400		14.0400	0.1800	2.5272			(29a)
External Roof 1	53.0000		53.0000	0.1100	5.8300			(30)
Total net area of external elements Aum(A, m2)			111.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.2487			(33)
Party Wall 1			20.2200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		5.5565 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.8052 (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	24.3864	24.2545	24.1251	23.5176	23.4039	22.8747	22.8747	22.7767	23.0785	23.4039	23.6338	23.8743	(38)
Heat transfer coeff	56.1916	56.0597	55.9303	55.3227	55.2091	54.6799	54.6799	54.5819	54.8837	55.2091	55.4390	55.6794	(39)

Average = Sum(39)m / 12 = 55.3222

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0602	1.0577	1.0553	1.0438	1.0417	1.0317	1.0317	1.0298	1.0355	1.0417	1.0460	1.0506	(40)

HLP (average)												1.0438
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7786 (42)
Hot water usage for mixer showers												
	54.0401	53.2280	52.0446	49.7804	48.1094	46.2459	45.1868	46.3612	47.6487	49.6494	51.9623	53.8331 (42a)
Hot water usage for baths												
	23.3623	23.0153	22.5267	21.6258	20.9512	20.2033	19.7992	20.2844	20.8127	21.6131	22.5325	23.2833 (42b)
Hot water usage for other uses												
	32.8442	31.6499	30.4556	29.2612	28.0669	26.8726	26.8726	28.0669	29.2612	30.4556	31.6499	32.8442 (42c)
Average daily hot water use (litres/day)												101.3421 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	110.2466	107.8932	105.0269	100.6674	97.1275	93.3218	91.8586	94.7125	97.7226	101.7180	106.1447	109.9606	(44)
Energy conte	174.6037	153.6385	161.4224	137.8086	130.7523	114.7500	111.0950	117.2739	120.5017	138.0304	151.2226	172.1717	(45)
Energy content (annual)										Total = Sum(45)m =		1683.2709	
Distribution loss (46)m = 0.15 x (45)m													
	26.1906	23.0458	24.2134	20.6713	19.6128	17.2125	16.6642	17.5911	18.0753	20.7046	22.6834	25.8258	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	223.1557	197.4919	209.9744	184.7945	179.3044	161.7358	159.6470	165.8259	167.4875	186.5825	198.2084	220.7238	(62)
WWHRS	-24.7049	-21.8492	-22.8792	-18.9449	-17.6560	-15.1083	-14.1617	-15.0595	-15.6317	-18.4280	-20.8767	-24.2474	(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													
	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3843	(64)
12Total per year (kWh/year)												2025	(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													
	96.8974	86.1676	92.5146	83.4100	82.3168	75.7430	75.7807	77.8352	77.6555	84.7367	87.8702	96.0887	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.1502	89.8448	81.1502	83.8552	81.1502	83.8552	81.1502	81.1502	83.8552	81.1502	83.8552	81.1502	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)													
	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)													
	130.2384	128.2255	124.3475	115.8473	110.6408	105.1987	101.8558	104.6172	107.8548	113.8935	122.0419	129.1515	(72)
Total internal gains													
	419.0848	427.3752	410.7489	396.3240	377.5191	361.5437	348.6560	349.8088	359.8050	374.7683	396.5152	411.1581	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.2200	10.6334	0.6300	0.7000	0.7700	23.4629	(74)
Southeast	1.4900	36.7938	0.6300	0.7000	0.7700	16.7546	(77)

Solar gains	40.2174	73.3779	115.2405	170.7669	219.0553	230.2911	216.6459	178.2642	133.8888	84.9166	49.0126	33.8982	(83)
Total gains	459.3022	500.7531	525.9894	567.0909	596.5744	591.8347	565.3019	528.0730	493.6938	459.6849	445.5278	445.0563	(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	65.5001	65.6543	65.8061	66.5288	66.6658	67.3109	67.3109	67.4318	67.0610	66.6658	66.3892	66.1026	
alpha	5.3667	5.3770	5.3871	5.4353	5.4444	5.4874	5.4874	5.4955	5.4707	5.4444	5.4259	5.4068	
util living area													
	0.9888	0.9808	0.9636	0.9054	0.7752	0.5773	0.4233	0.4712	0.7160	0.9220	0.9778	0.9905	(86)
MIT	20.0043	20.1536	20.3740	20.6784	20.8948	20.9829	20.9974	20.9954	20.9479	20.6898	20.3094	19.9812	(87)
Th 2	20.0335	20.0355	20.0375	20.0470	20.0487	20.0570	20.0570	20.0585	20.0538	20.0487	20.0452	20.0414	(88)
util rest of house													
	0.9855	0.9751	0.9525	0.8777	0.7194	0.4983	0.3338	0.3770	0.6367	0.8929	0.9701	0.9876	(89)
MIT 2	18.8950	19.0846	19.3610	19.7322	19.9647	20.0477	20.0562	20.0570	20.0209	19.7544	19.2899	18.8718	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.4721	19.6407	19.8880	20.2244	20.4485	20.5342	20.5458	20.5451	20.5031	20.2410	19.8202	19.4489	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4721	19.6407	19.8880	20.2244	20.4485	20.5342	20.5458	20.5451	20.5031	20.2410	19.8202	19.4489	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9830	0.9722	0.9504	0.8834	0.7440	0.5389	0.3805	0.4261	0.6759	0.8996	0.9678	0.9853	(94)
Useful gains	451.4859	486.8345	499.9088	500.9799	443.8343	318.9515	215.0776	225.0167	333.6895	413.5201	431.2000	438.5080	(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													
	852.5444	826.3601	748.7930	626.4964	482.9971	324.4812	215.7545	226.2484	351.4278	532.2681	705.1982	849.0481	(97)
Space heating kWh													
	298.3876	228.1612	185.1698	90.3719	29.1371	0.0000	0.0000	0.0000	0.0000	88.3485	197.2787	305.4418	(98a)
Space heating requirement - total per year (kWh/year)												1422.2966	
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													
	298.3876	228.1612	185.1698	90.3719	29.1371	0.0000	0.0000	0.0000	0.0000	88.3485	197.2787	305.4418	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1422.2966	
Space heating per m2											(98c) / (4) =	26.8358	(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													
	298.3876	228.1612	185.1698	90.3719	29.1371	0.0000	0.0000	0.0000	0.0000	88.3485	197.2787	305.4418	(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)													
	323.2801	247.1952	200.6173	97.9111	31.5678	0.0000	0.0000	0.0000	0.0000	95.7188	213.7365	330.9229	(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													
	198.4509	175.6427	187.0952	165.8496	161.6484	146.6275	145.4853	150.7664	151.8558	168.1544	177.3317	196.4764	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9722	84.6475	84.0366	82.7584	81.0546	79.8000	79.8000	79.8000	79.8000	82.6865	84.2994	85.0454	(217)
Fuel for water heating, kWh/month													
	233.5481	207.4991	222.6354	200.4020	199.4314	183.7437	182.3124	188.9303	190.2955	203.3638	210.3594	231.0254	(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	16.8614	13.5268	12.1794	8.9232	6.8925	5.6312	6.2876	8.1728	10.6157	13.9284	15.7321	17.3300	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3367	-21.3139	-32.2925	-38.3464	-43.1634	-40.9757	-40.4979	-37.3400	-32.0730	-25.2773	-16.1553	-12.2713	(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	-5.0639	-10.8975	-22.1172	-33.8930	-45.4704	-45.9090	-45.3474	-38.0761	-27.5067	-15.7802	-6.8249	-3.9849	(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	1540.9497 (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	2453.5467 (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)	136.0812 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-654.9144 (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	3561.6632 (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	1540.9497	0.2100	323.5994	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2453.5467	0.2100	515.2448	(264)
Space and water heating			838.8443	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	136.0812	0.1443	19.6407	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.0433	0.1335	-47.2537	
PV Unit electricity exported	-300.8711	0.1253	-37.7061	
Total			-84.9598	(269)
Total CO2, kg/year			785.4545	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.8200	(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	1540.9497	1.1300	1741.2732	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2453.5467	1.1300	2772.5078	(278)
Space and water heating			4513.7810	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	136.0812	1.5338	208.7258	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-354.0433	1.4932	-528.6623	
PV Unit electricity exported	-300.8711	0.4600	-138.3993	
Total			-667.0616	(283)
Total Primary energy kWh/year			4185.5460	(286)
Target Primary Energy Rate (TPER)			78.9700	(287)

Full SAP Calculation Printout

Property Reference	Flat 1 HH - Be Green.	Issued on Date	06/05/2023
Assessment Reference	Flat 1HH - Be Green.	Prop Type Ref	
Property	Flat 1 HH, West Central Street, London, WC1A		

SAP Rating	74 C	DER	7.73	TER	20.23
Environmental	95 A	% DER < TER			61.79
CO_2 Emissions (t/year)	0.35	DFEE	55.62	TFEE	56.61
Compliance Check	See BREL	% DFEE < TFEE			1.77
% DPER < TPER	24.72	DPER	81.71	TPER	108.54

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	50.0000	(1b)	x 2.8600	(2b) =	143.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		143.0000	(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		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(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) =	84.6000 (23c)

Effective ac	0.2396	0.2364	0.2332	0.2172	0.2141	0.1981	0.1981	0.1949	0.2045	0.2141	0.2204	0.2268	(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 = 0.95)			23.3100	0.9152	21.3338			(27)
Glazed Door (Uw = 0.95)			9.6800	0.9152	8.8593			(27)
Heat Loss Floor			32.2600	0.1000	3.2260	0.3000	9.6780	(28b)

Floor Over Retail			17.7400	0.1000	1.7740	0.3000	5.3220 (28b)
External Wall 1	81.6200	32.9900	48.6300	0.1600	7.7808	14.0000	680.8200 (29a)
Shelt Unheated Wall	8.3800		8.3800	0.1600	1.3408	14.0000	117.3200 (29a)
Total net area of external elements Aum(A, m2)			140.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3148		(33)
Sheltered Heated			6.4600	0.0000	0.0000	20.0000	129.2000 (32)
Party Ceiling 1			50.0000			30.0000	1500.0000 (32b)
Internal Wall 1			54.6800			9.0000	492.1200 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 2934.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 58.6892 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E20 Exposed floor (normal)	31.4700	0.1250	3.9337
E16 Corner (normal)	8.5800	0.0900	0.7722
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.1900	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	16.2000	0.0500	0.8100
E3 Sill	16.2000	0.0500	0.8100
E4 Jamb	47.9000	0.0500	2.3950
E7 Party floor between dwellings (in blocks of flats)	31.4700	0.0700	2.2029
E18 Party wall between dwellings	5.7200	0.0600	0.3432

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.2670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.5818 (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	11.3050	11.1545	11.0041	10.2520	10.1016	9.3495	9.3495	9.1991	9.6504	10.1016	10.4024	10.7033	(38)
Heat transfer coeff	66.8868	66.7363	66.5859	65.8338	65.6834	64.9313	64.9313	64.7809	65.2322	65.6834	65.9843	66.2851	(39)

Average = Sum(39)m / 12 = 65.7962

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3377	1.3347	1.3317	1.3167	1.3137	1.2986	1.2986	1.2956	1.3046	1.3137	1.3197	1.3257	(40)
HLP (average)												1.3159	
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 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.2000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.6480 (55)
Total storage loss

20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)

If cylinder contains dedicated solar storage

20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss

Total heat required for water heating calculated for each month

213.1601	188.5755	200.3410	175.9771	170.5130	153.5516	151.3952	157.4045	159.1452	177.5910	189.0226	210.7949	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS

Output from w/h

213.1601	188.5755	200.3410	175.9771	170.5130	153.5516	151.3952	157.4045	159.1452	177.5910	189.0226	210.7949	(64)

Total per year (kWh/year) = Sum(64)m = 2147.4717 (64)
12Total per year (kWh/year) 2147 (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

91.1421	81.0064	86.8797	78.1250	76.9619	70.6685	70.6052	72.6033	72.5283	79.3153	82.4626	90.3556	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	122.5028	120.5452	116.7738	108.5069	103.4434	98.1507	94.8995	97.5851	100.7338	106.6066	114.5313	121.4457	(72)
Total internal gains													
	392.3508	399.8779	384.2996	370.3118	352.4264	339.8849	327.6620	328.8197	338.2940	349.8877	370.6343	384.7974	(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	
Northeast	8.8000	11.2829	0.4700	0.7000	0.7700	22.6378	(75)
Southeast	14.5100	36.7938	0.4700	0.7000	0.7700	121.7227	(77)
Northeast	7.3500	11.2829	0.4700	0.7000	0.7700	18.9077	(75)
Northwest	2.3300	11.2829	0.4700	0.7000	0.7700	5.9939	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	169.2621	304.1066	458.0347	637.8298	778.5914	801.1868	760.6833	651.3536	519.6180	347.4114	205.6126	142.9923	(83)
Total gains	561.6129	703.9844	842.3343	1008.1415	1131.0178	1141.0718	1088.3453	980.1733	857.9120	697.2991	576.2469	527.7898	(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	12.1867	12.2142	12.2417	12.3816	12.4099	12.5537	12.5537	12.5828	12.4958	12.4099	12.3534	12.2973	
alpha	1.8124	1.8143	1.8161	1.8254	1.8273	1.8369	1.8369	1.8389	1.8331	1.8273	1.8236	1.8198	
util living area													
	0.8328	0.7699	0.6880	0.5682	0.4424	0.3258	0.2455	0.2795	0.4335	0.6396	0.7821	0.8461	(86)
Living	18.4216	18.8530	19.3962	19.9956	20.4202	20.6704	20.7663	20.7452	20.5410	19.9446	19.0870	18.3423	
Non living	16.9119	17.4274	18.0714	18.7701	19.2412	19.5095	19.5967	19.5843	19.3903	18.7404	17.7299	16.8208	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6892	18.8530	19.3962	19.9956	20.4202	20.6704	20.7663	20.7452	20.5410	19.9446	19.0870	18.7169	(87)
Th 2	19.8114	19.8137	19.8161	19.8278	19.8301	19.8419	19.8419	19.8443	19.8372	19.8301	19.8254	19.8208	(88)
util rest of house													
	0.8166	0.7492	0.6613	0.5340	0.4003	0.2748	0.1857	0.2159	0.3768	0.6004	0.7588	0.8309	(89)
MIT 2	18.6335	17.4274	18.0714	18.7701	19.2412	19.5095	19.5967	19.5843	19.3903	18.7404	17.7299	17.3534	(90)
Living area fraction										fLA = Living area / (4) =		0.6934	(91)
MIT	19.3655	18.4159	18.9900	19.6199	20.0587	20.3145	20.4077	20.3893	20.1882	19.5754	18.6709	18.2989	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3655	18.4159	18.9900	19.6199	20.0587	20.3145	20.4077	20.3893	20.1882	19.5754	18.6709	18.2989	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8098	0.7212	0.6408	0.5275	0.4088	0.2961	0.2155	0.2465	0.3946	0.5910	0.7322	0.8077	(94)
Useful gains	454.8103	507.6990	539.7529	531.8429	462.3799	337.8780	234.4909	241.6496	338.5533	412.1320	421.9125	426.3167	(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													
	1007.6838	902.0051	831.6615	705.7295	549.0293	371.0473	247.2376	258.4290	397.1434	589.5328	763.4975	934.5451	(97)
Space heating kWh													
	411.3379	264.9737	217.1800	125.1984	64.4672	0.0000	0.0000	0.0000	0.0000	131.9862	245.9412	378.1219	(98a)
Space heating requirement - total per year (kWh/year)												1839.2065	
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													
	411.3379	264.9737	217.1800	125.1984	64.4672	0.0000	0.0000	0.0000	0.0000	131.9862	245.9412	378.1219	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1839.2065	
Space heating per m2											(98c) / (4) =	36.7841	(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	610.3545	480.4918	492.3349	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8494	0.8842	0.8613	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	518.4112	424.8293	424.0414	0.0000	0.0000	0.0000	0.0000	(102)

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1294.7112	1234.8555	1109.2155	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	558.9360	602.6595	509.7695	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		0.8940	(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	124.9222	134.6944	113.9335	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												373.5501	(107)

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 %)												180.9940	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)												4.0300	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	411.3379	264.9737	217.1800	125.1984	64.4672	0.0000	0.0000	0.0000	0.0000	131.9862	245.9412	378.1219	(98)
Space heating efficiency (main heating system 1)													
	180.9940	180.9940	180.9940	180.9940	180.9940	0.0000	0.0000	0.0000	0.0000	180.9940	180.9940	180.9940	(210)
Space heating fuel (main heating system)													
	227.2661	146.3992	119.9930	69.1727	35.6184	0.0000	0.0000	0.0000	0.0000	72.9230	135.8837	208.9141	(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													
	213.1601	188.5755	200.3410	175.9771	170.5130	153.5516	151.3952	157.4045	159.1452	177.5910	189.0226	210.7949	(64)
Efficiency of water heater												167.0720	(216)
(217)m	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	167.0720	(217)
Fuel for water heating, kWh/month													
	127.5858	112.8708	119.9129	105.3301	102.0596	91.9074	90.6168	94.2135	95.2554	106.2961	113.1384	126.1701	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	30.9981	33.4229	28.2713	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	12.8613	11.6166	12.8613	12.4464	12.8613	12.4464	12.8613	12.8613	12.4464	12.8613	12.4464	12.8613	(231)
Lighting	13.6431	10.9450	9.8548	7.2200	5.5770	4.5564	5.0875	6.6129	8.5895	11.2699	12.7293	14.0223	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1016.1701	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	167.0720	
Water heating fuel used	1285.3570	(219)
Space cooling fuel	92.6923	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)		
mechanical ventilation fans (SFP = 0.8680)	151.4313	(230a)
Total electricity for the above, kWh/year	151.4313	(231)
Electricity for lighting (calculated in Appendix L)	110.1077	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2655.7584	(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	1016.1701	0.1554	157.9095	(261)

Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1285.3570	0.1409	181.1029	(264)
Space and water heating			339.0123	(265)
Space cooling	92.6923	0.1143	10.5961	(266)
Pumps, fans and electric keep-hot	151.4313	0.1387	21.0054	(267)
Energy for lighting	110.1077	0.1443	15.8919	(268)
Total CO2, kg/year			386.5058	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.7300	(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	1016.1701	1.5753	1600.7231	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1285.3570	1.5210	1955.0096	(278)
Space and water heating			3555.7328	(279)
Space cooling	92.6923	1.4213	131.7419	(280)
Pumps, fans and electric keep-hot	151.4313	1.5128	229.0852	(281)
Energy for lighting	110.1077	1.5338	168.8869	(282)
Total Primary energy kWh/year			4085.4468	(286)
Dwelling Primary energy Rate (DPER)			81.7100	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.8600	(2b) =	143.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		143.0000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1399	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3899	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3314	(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	0.4225	0.4142	0.4059	0.3645	0.3562	0.3148	0.3148	0.3065	0.3314	0.3562	0.3728	0.3894	(22b)
Effective ac	0.5893	0.5858	0.5824	0.5664	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(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 Opening Type (Uw = 1.20)			12.4900	1.1450	14.3015			(27)

Heat Loss Floor			32.2600	0.1300	4.1938	(28b)
Floor Over Retail			17.7400	0.1300	2.3062	(28b)
External Wall 1	81.6200	12.4900	69.1300	0.1800	12.4434	(29a)
Shelt Unheated Wall	8.3800		8.3800	0.1800	1.5084	(29a)
Total net area of external elements Aum(A, m2)			140.0000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.7533	(33)
Sheltered Heated			6.4600	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 68.6892 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E20 Exposed floor (normal)	31.4700	0.3200	10.0704
E16 Corner (normal)	8.5800	0.0900	0.7722
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.1900	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	16.2000	0.0500	0.8100
E3 Sill	16.2000	0.0500	0.8100
E4 Jamb	47.9000	0.0500	2.3950
E7 Party floor between dwellings (in blocks of flats)	31.4700	0.0700	2.2029
E18 Party wall between dwellings	5.7200	0.0600	0.3432

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4037 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 52.1570 (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	27.8071	27.6435	27.4832	26.7302	26.5893	25.9334	25.9334	25.8120	26.1860	26.5893	26.8743	27.1723	(38)
Heat transfer coeff	79.9641	79.8005	79.6402	78.8872	78.7463	78.0904	78.0904	77.9690	78.3431	78.7463	79.0313	79.3293	(39)

Average = Sum(39)m / 12 = 78.8865

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5993	1.5960	1.5928	1.5777	1.5749	1.5618	1.5618	1.5594	1.5669	1.5749	1.5806	1.5866	(40)
HLP (average)												1.5777	
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 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

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

25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(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

216.4047	191.5060	203.5855	179.1170	173.7575	156.6915	154.6398	160.6490	162.2850	180.8355	192.1624	214.0394	(62)
WWHRS -24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(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												
192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575	(64)

Total per year (kWh/year) = Sum(64)m = 1962.4258 (64)

12Total per year (kWh/year) 1962 (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

93.7377	83.3508	89.4753	80.6368	79.5575	73.1803	73.2008	75.1989	75.0402	81.9109	84.9744	92.9512	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	125.9915	124.0340	120.2625	111.9956	106.9321	101.6394	98.3882	101.0738	104.2225	110.0953	118.0201	124.9344	(72)
Total internal gains													
	398.8396	406.3666	390.7883	376.8005	358.9151	343.3736	331.1507	332.3085	341.7827	356.3764	377.1230	391.2862	(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	
Northeast	6.1100	11.2829	0.6300	0.7000	0.7700	21.0686	(75)
Southeast	5.5000	36.7938	0.6300	0.7000	0.7700	61.8457	(77)
Northwest	0.8800	11.2829	0.6300	0.7000	0.7700	3.0344	(81)

Solar gains	85.9487	154.4085	232.5340	323.7651	395.1782	406.6313	386.0805	330.6152	263.7827	176.3880	104.4047	72.6108	(83)
Total gains	484.7883	560.7751	623.3223	700.5655	754.0934	750.0049	717.2312	662.9236	605.5653	532.7645	481.5277	463.8969	(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	11.9306	11.9550	11.9791	12.0934	12.1151	12.2168	12.2168	12.2358	12.1774	12.1151	12.0714	12.0260	
alpha	1.7954	1.7970	1.7986	1.8062	1.8077	1.8145	1.8145	1.8157	1.8118	1.8077	1.8048	1.8017	
util living area													
	0.8903	0.8591	0.8153	0.7377	0.6344	0.5101	0.4039	0.4421	0.6073	0.7708	0.8593	0.8973	(86)
MIT	17.2242	17.6410	18.2919	19.1559	19.9288	20.5029	20.7716	20.7216	20.2688	19.2779	18.1183	17.1522	(87)
Th 2	19.6139	19.6163	19.6186	19.6297	19.6318	19.6415	19.6415	19.6433	19.6377	19.6318	19.6276	19.6232	(88)
util rest of house													
	0.8763	0.8415	0.7916	0.7027	0.5820	0.4324	0.2999	0.3375	0.5340	0.7321	0.8388	0.8842	(89)
MIT 2	15.4394	15.9444	16.7324	17.7634	18.6518	19.2732	19.5227	19.4886	19.0526	17.9373	16.5427	15.3540	(90)
Living area fraction										fLA = Living area / (4) =		0.6934	(91)
MIT	16.6770	17.1208	17.8138	18.7290	19.5373	20.1259	20.3887	20.3436	19.8959	18.8669	17.6352	16.6008	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.6770	17.1208	17.8138	18.7290	19.5373	20.1259	20.3887	20.3436	19.8959	18.8669	17.6352	16.6008	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8360	0.8003	0.7531	0.6758	0.5780	0.4618	0.3595	0.3942	0.5492	0.7062	0.8000	0.8447	(94)
Useful gains	405.3062	448.7836	469.4229	473.4486	435.8559	346.3313	257.8569	261.3096	332.5733	376.2570	385.2215	391.8559	(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													
	989.7151	975.2263	901.0311	775.3797	617.1589	431.5206	295.8579	307.4779	454.0695	650.9855	832.6135	983.7505	(97)
Space heating kWh													
	434.8002	353.7695	321.1165	217.3904	134.8894	0.0000	0.0000	0.0000	0.0000	204.3980	322.1223	440.3696	(98a)
Space heating requirement - total per year (kWh/year)												2428.8560	
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													
	434.8002	353.7695	321.1165	217.3904	134.8894	0.0000	0.0000	0.0000	0.0000	204.3980	322.1223	440.3696	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2428.8560	
Space heating per m2											(98c) / (4) =	48.5771	(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													
	434.8002	353.7695	321.1165	217.3904	134.8894	0.0000	0.0000	0.0000	0.0000	204.3980	322.1223	440.3696	(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)													
	471.0728	383.2823	347.9052	235.5259	146.1424	0.0000	0.0000	0.0000	0.0000	221.4496	348.9949	477.1068	(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

192.3778	170.2565	181.3342	160.6920	156.5861	141.9978	140.8668	146.0028	147.0824	162.9133	171.8587	190.4575 (64)

Efficiency of water heater

											79.8000 (216)
(217)m	85.8308	85.6611	85.3269	84.7381	83.7271	79.8000	79.8000	79.8000	79.8000	84.5696	85.4473	85.8759 (217)

Fuel for water heating, kWh/month

224.1362	198.7558	212.5169	189.6337	187.0196	177.9421	176.5248	182.9609	184.3137	192.6380	201.1284	221.7824 (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	15.4303	12.3788	11.1457	8.1658	6.3075	5.1533	5.7539	7.4792	9.7147	12.7462	14.3968	15.8592 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-11.1919	-16.8462	-25.8393	-31.0763	-35.3295	-33.6667	-33.2742	-30.5081	-25.9527	-20.1433	-12.6827	-9.5568 (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	-3.4501	-7.4642	-15.2246	-23.4440	-31.5640	-31.9066	-31.5147	-26.4097	-19.0132	-10.8434	-4.6609	-2.7120 (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	2631.4800 (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	2349.3525 (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)	124.5314 (232)

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

PV generation	-494.2751 (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	4697.0889 (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	2631.4800	0.2100	552.6108	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2349.3525	0.2100	493.3640	(264)
Space and water heating			1045.9748	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.5314	0.1443	17.9737	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0677	0.1332	-38.1094	
PV Unit electricity exported	-208.2073	0.1252	-26.0648	
Total			-64.1742	(269)
Total CO2, kg/year			1011.7037	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.2300	(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	2631.4800	1.1300	2973.5724	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2349.3525	1.1300	2654.7684	(278)
Space and water heating			5628.3407	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.5314	1.5338	191.0104	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0677	1.4923	-426.8912	
PV Unit electricity exported	-208.2073	0.4595	-95.6687	
Total			-522.5599	(283)
Total Primary energy kWh/year			5426.8921	(286)
Target Primary Energy Rate (TPER)			108.5400	(287)

Full SAP Calculation Printout

Property Reference	Flat 2 HH - Be Green.	Issued on Date	06/05/2023
Assessment Reference	Flat 2 HH - Be Green.	Prop Type Ref	
Property	Flat 1 HH, West Central Street, London, WC1A		

SAP Rating	77 C	DER	6.10	TER	14.98
Environmental	95 A	% DER < TER			59.28
CO_2 Emissions (t/year)	0.33	DFEE	39.94	TFEE	40.44
Compliance Check	See BREL	% DFEE < TFEE			1.23
% DPER < TPER	19.05	DPER	64.80	TPER	80.05

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	60.0000 (1b)	x	2.8600 (2b)	=	171.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 60.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	171.6000	(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		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(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) =	84.6000 (23c)

Effective ac	0.2396	0.2364	0.2332	0.2172	0.2141	0.1981	0.1981	0.1949	0.2045	0.2141	0.2204	0.2268	(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	
Windows (Uw = 0.95)			17.5300	0.9152	16.0438			(27)
Glazed Door (Uw = 0.95)			7.3500	0.9152	6.7269			(27)
Floor			1.8000	0.1200	0.2160			(28b)

External Wall 1	87.9200	24.8800	63.0400	0.1600	10.0864	14.0000	882.5600 (29a)
Shelt Unheated Wall	1.9700		1.9700	0.1600	0.3152	14.0000	27.5800 (29a)
Total net area of external elements Aum(A, m2)			91.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3883		(33)
Sheltered Heated			11.1500	0.0000	0.0000	20.0000	223.0000 (32)
Party Floor 1			58.2000			40.0000	2328.0000 (32d)
Party Ceiling 1			60.0000			30.0000	1800.0000 (32b)
Internal Wall 1			80.6500			9.0000	725.8500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5986.9900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		99.7832	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.1000	0.0500	0.6050
E3 Sill	12.1000	0.0500	0.6050
E4 Jamb	40.0000	0.0500	2.0000
E7 Party floor between dwellings (in blocks of flats)	62.9400	0.0700	4.4058
E16 Corner (normal)	8.5800	0.0900	0.7722
E18 Party wall between dwellings	2.8600	0.0600	0.1716
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.8000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.5596	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	41.9479	(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	13.5659	13.3854	13.2049	12.3024	12.1219	11.2194	11.2194	11.0389	11.5804	12.1219	12.4829	12.8439	(38)
Heat transfer coeff	55.5139	55.3334	55.1529	54.2503	54.0698	53.1673	53.1673	52.9868	53.5283	54.0698	54.4308	54.7919	(39)
Average = Sum(39)m / 12 =												54.2052	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9252	0.9222	0.9192	0.9042	0.9012	0.8861	0.8861	0.8831	0.8921	0.9012	0.9072	0.9132	(40)
HLP (average)												0.9034	
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												1.9816 (42)
Hot water usage for mixer showers	92.1881	90.8027	88.7839	84.9213	82.0708	78.8919	77.0850	79.0885	81.2848	84.6979	88.6435	91.8349 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	34.9239	33.6540	32.3840	31.1140	29.8441	28.5741	28.5741	29.8441	31.1140	32.3840	33.6540	34.9239 (42c)
Average daily hot water use (litres/day)												116.7434 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.1120	124.4567	121.1679	116.0353	111.9148	107.4660	105.6591	108.9326	112.3988	117.0819	122.2975	126.7588	(44)
Energy conte	201.3144	177.2247	186.2306	158.8465	150.6589	132.1420	127.7855	134.8813	138.5990	158.8791	174.2352	198.4737	(45)
Energy content (annual)										Total = Sum(45)m =		1939.2708	
Distribution loss (46)m = 0.15 x (45)m	30.1972	26.5837	27.9346	23.8270	22.5988	19.8213	19.1678	20.2322	20.7898	23.8319	26.1353	29.7711	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6480	(55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(64)
										Total per year (kWh/year) = Sum(64)m =		2449.6868	(64)
12Total per year (kWh/year)												2450	(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	101.6174	90.2514	96.6020	86.3781	84.7744	77.4988	77.1690	79.5284	79.6458	87.5076	91.4948	100.6728	(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	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	87.2319	96.5781	87.2319	90.1396	87.2319	90.1396	87.2319	87.2319	90.1396	87.2319	90.1396	87.2319	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
172.9469 174.7416 170.2191 160.5914 148.4380 137.0156 129.3847 127.5901 132.1125 141.7403 153.8936 165.3161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 (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)
-79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 (71)
Water heating gains (Table 5)
136.5825 134.3026 129.8414 119.9696 113.9441 107.6372 103.7218 106.8930 110.6191 117.6178 127.0761 135.3129 (72)
Total internal gains
449.4858 458.3468 440.0169 423.4250 402.3385 387.5169 373.0629 374.4394 385.5958 399.3144 423.8339 440.5854 (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	
Northeast	4.2000	11.2829	0.4700	0.7000	0.7700	10.8044	(75)
Southeast	11.0000	36.7938	0.4700	0.7000	0.7700	92.2777	(77)
Northwest	2.3300	11.2829	0.4700	0.7000	0.7700	5.9939	(81)
Northeast	7.3500	11.2829	0.4700	0.7000	0.7700	18.9077	(75)

Solar gains 127.9837 229.8636 346.0120 481.5286 587.5484 604.4994 573.9795 491.6430 392.4309 262.5422 155.4548 108.1298 (83)
Total gains 577.4695 688.2105 786.0289 904.9537 989.8868 992.0163 947.0424 866.0824 778.0267 661.8566 579.2887 548.7152 (84)

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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	29.9574	30.0552	30.1535	30.6552	30.7575	31.2796	31.2796	31.3862	31.0686	30.7575	30.5535	30.3522	
alpha	2.9972	3.0037	3.0102	3.0437	3.0505	3.0853	3.0853	3.0924	3.0712	3.0505	3.0369	3.0235	
util living area	0.8925	0.8374	0.7571	0.6222	0.4741	0.3346	0.2445	0.2774	0.4481	0.6888	0.8421	0.9034	(86)
Living	19.7580	20.0259	20.3302	20.6387	20.8057	20.8770	20.8938	20.8908	20.8420	20.6019	20.1498	19.7172	
Non living	18.6960	19.0257	19.3946	19.7642	19.9495	20.0333	20.0476	20.0483	19.9978	19.7349	19.1946	18.6536	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3646	20.0259	20.3302	20.6387	20.8057	20.8770	20.8938	20.8908	20.8420	20.6019	20.1498	19.8966	(87)
Th 2	20.1461	20.1487	20.1512	20.1640	20.1665	20.1793	20.1793	20.1819	20.1742	20.1665	20.1614	20.1563	(88)
util rest of house	0.8805	0.8208	0.7343	0.5918	0.4377	0.2939	0.1998	0.2294	0.4007	0.6541	0.8232	0.8924	(89)
MIT 2	19.5680	19.0257	19.3946	19.7642	19.9495	20.0333	20.0476	20.0483	19.9978	19.7349	19.1946	18.9244	(90)
Living area fraction										fLA = Living area / (4) =		0.7182	(91)
MIT	20.1401	19.7440	20.0665	20.3922	20.5644	20.6392	20.6553	20.6534	20.6041	20.3576	19.8806	19.6226	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1401	19.7440	20.0665	20.3922	20.5644	20.6392	20.6553	20.6534	20.6041	20.3576	19.8806	19.6226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8804	0.8122	0.7318	0.6004	0.4553	0.3169	0.2258	0.2572	0.4257	0.6624	0.8163	0.8847	(94)
Useful gains	508.3960	558.9624	575.2543	543.2987	450.7293	314.3331	213.8736	222.7685	331.2350	438.3883	472.8993	485.4282	(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	879.3454	821.3691	748.2329	623.4566	479.2979	321.0886	215.6097	225.3732	348.1519	527.5905	695.6578	845.0347	(97)
Space heating kWh	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98a)
Space heating requirement - total per year (kWh/year)												1154.2882	
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	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1154.2882	
Space heating per m2											(98c) / (4) =	19.2381	(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	499.7729	393.4383	402.6999	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9516	0.9701	0.9603	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	475.5967	381.6936	386.6986	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1113.5185	1063.0499	969.3521	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	459.3037	506.9291	433.4942	0.0000	0.0000	0.0000	0.0000 (104)

Cooled fraction — fC = cooled area / (4) = 0.9117 (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	104.6830	115.5376	98.8006	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling requirement — 319.0211 (107)

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 %) — 169.5759 (206)

Efficiency of main space heating system 2 (in %) — 0.0000 (207)

Efficiency of secondary/supplementary heating system, % — 0.0000 (208)

Cooling System Energy Efficiency Ratio (see Table 10c) — 4.0300 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98)
Space heating efficiency (main heating system 1)	169.5759	169.5759	169.5759	169.5759	169.5759	0.0000	0.0000	0.0000	0.0000	169.5759	169.5759	169.5759	(210)
Space heating fuel (main heating system)	162.7509	103.9873	75.8929	34.0341	12.5342	0.0000	0.0000	0.0000	0.0000	39.1367	94.5807	157.7743	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(64)
Efficiency of water heater												167.3400	(216)
(217)m	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	(217)
Fuel for water heating, kWh/month	146.2082	129.3055	137.1943	119.9943	115.9372	104.0361	102.2684	106.5087	107.8947	120.8494	129.1904	144.5106	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	25.9759	28.6694	24.5163	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.4335	13.9400	15.4335	14.9357	15.4335	14.9357	15.4335	15.4335	14.9357	15.4335	14.9357	15.4335	(231)
Lighting	16.0257	12.8564	11.5758	8.4809	6.5509	5.3522	5.9760	7.7678	10.0896	13.2381	14.9524	16.4712	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 — 680.6912 (211)

Space heating fuel - main system 2 — 0.0000 (213)

Space heating fuel - secondary — 0.0000 (215)

Efficiency of water heater — 167.3400

Water heating fuel used — 1463.8979 (219)

Space cooling fuel — 79.1616 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)

mechanical ventilation fans (SFP = 0.8680) — 181.7175 (230a)

Total electricity for the above, kWh/year — 181.7175 (231)

Electricity for lighting (calculated in Appendix L) — 129.3369 (232)

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

PV generation — 0.0000 (233)

Wind generation — 0.0000 (234)

Hydro-electric generation (Appendix N) — 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) — 0.0000 (235)

Appendix Q - special features

Energy saved or generated — -0.0000 (236)

Energy used — 0.0000 (237)

Total delivered energy for all uses — 2534.8052 (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	680.6912	0.1566	106.6209	(261)
Total CO2 associated with community systems			0.0000	(373)

Water heating (other fuel)	1463.8979	0.1410	206.4012 (264)
Space and water heating			313.0221 (265)
Space cooling	79.1616	0.1143	9.0452 (266)
Pumps, fans and electric keep-hot	181.7175	0.1387	25.2065 (267)
Energy for lighting	129.3369	0.1443	18.6673 (268)
Total CO2, kg/year			365.9411 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.1000 (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	680.6912	1.5798	1075.3778	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1463.8979	1.5214	2227.1018	(278)
Space and water heating			3302.4796	(279)
Space cooling	79.1616	1.4211	112.4966	(280)
Pumps, fans and electric keep-hot	181.7175	1.5128	274.9023	(281)
Energy for lighting	129.3369	1.5338	198.3813	(282)
Total Primary energy kWh/year			3888.2598	(286)
Dwelling Primary energy Rate (DPER)			64.8000	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		60.0000 (1b)	x	2.8600 (2b)	=	171.6000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	171.6000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1166	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3666	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3116	(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	0.3972	0.3895	0.3817	0.3427	0.3349	0.2960	0.2960	0.2882	0.3116	0.3349	0.3505	0.3661	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(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 Opening Type (Uw = 1.20)			14.9900	1.1450	17.1641			(27)
Floor			1.8000	0.1300	0.2340			(28b)

External Wall 1	87.9200	14.9900	72.9300	0.1800	13.1274	(29a)
Shelt Unheated Wall	1.9700		1.9700	0.1800	0.3546	(29a)
Total net area of external elements Aum(A, m2)			91.6900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8801	(33)
Sheltered Heated			11.1500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.7832 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.1000	0.0500	0.6050
E3 Sill	12.1000	0.0500	0.6050
E4 Jamb	40.0000	0.0500	2.0000
E7 Party floor between dwellings (in blocks of flats)	62.9400	0.0700	4.4058
E16 Corner (normal)	8.5800	0.0900	0.7722
E18 Party wall between dwellings	2.8600	0.0600	0.1716
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.8000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5596 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 39.4397 (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	32.7821	32.6086	32.4386	31.6398	31.4903	30.7946	30.7946	30.6657	31.0626	31.4903	31.7926	32.1087	(38)
Heat transfer coeff	72.2219	72.0484	71.8783	71.0795	70.9300	70.2343	70.2343	70.1055	70.5023	70.9300	71.2324	71.5485	(39)

Average = Sum(39)m / 12 = 71.0788

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2037	1.2008	1.1980	1.1847	1.1822	1.1706	1.1706	1.1684	1.1750	1.1822	1.1872	1.1925	(40)
HLP (average)												1.1846	
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 1.9816 (42)

Hot water usage for mixer showers

73.7505	72.6422	71.0271	67.9370	65.6566	63.1135	61.6680	63.2708	65.0278	67.7583	70.9148	73.4679	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

34.9239	33.6540	32.3840	31.1140	29.8441	28.5741	28.5741	29.8441	31.1140	32.3840	33.6540	34.9239	(42c)

Average daily hot water use (litres/day) 99.7445 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6744	106.2961	103.4111	99.0511	95.5007	91.6876	90.2421	93.1149	96.1419	100.1423	104.5688	108.3919	(44)
Energy conte	172.1137	151.3643	158.9390	135.5959	128.5623	112.7406	109.1400	115.2957	118.5525	135.8922	148.9774	169.7154	(45)

Energy content (annual) Total = Sum(45)m = 1656.8892

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

25.8171	22.7046	23.8409	20.3394	19.2843	16.9111	16.3710	17.2944	17.7829	20.3838	22.3466	25.4573	(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

218.7086	193.4500	205.5339	180.6878	175.1572	157.8325	155.7349	161.8906	163.6444	182.4871	194.0692	216.3103	(62)
-33.7157	-29.8184	-31.2241	-25.8548	-24.0957	-20.6189	-19.3269	-20.5522	-21.3331	-25.1494	-28.4912	-33.0913	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

184.9930	163.6316	174.3098	154.8330	151.0614	137.2136	136.4080	141.3383	142.3113	157.3377	165.5780	183.2191	(64)

Total per year (kWh/year) = Sum(64)m = 1892.2348 (64)

12Total per year (kWh/year) 1892 (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

94.5037	83.9972	90.1232	81.1591	80.0229	73.5597	73.5650	75.6117	75.4922	82.4601	85.6085	93.7063	(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	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

87.2319	96.5781	87.2319	90.1396	87.2319	90.1396	87.2319	87.2319	90.1396	87.2319	90.1396	87.2319	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

172.9469	174.7416	170.2191	160.5914	148.4380	137.0156	129.3847	127.5901	132.1125	141.7403	153.8936	165.3161	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	(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)	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	(71)
Water heating gains (Table 5)	127.0211	124.9958	121.1333	112.7210	107.5576	102.1663	98.8777	101.6287	104.8503	110.8334	118.9006	125.9493	(72)
Total internal gains	442.9245	452.0401	434.3088	419.1765	398.9520	382.0460	368.2188	369.1751	379.8269	395.5301	418.6584	434.2218	(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	
Northeast	6.9600	11.2829	0.6300	0.7000	0.7700	23.9996	(75)
Southeast	6.6300	36.7938	0.6300	0.7000	0.7700	74.5522	(77)
Northwest	1.4000	11.2829	0.6300	0.7000	0.7700	4.8275	(81)

Solar gains	103.3793	185.6683	279.4729	388.9107	474.5234	488.2075	463.5614	397.0738	316.9590	212.0605	125.5682	87.3428	(83)
Total gains	546.3037	637.7083	713.7817	808.0872	873.4754	870.2535	831.7801	766.2490	696.7859	607.5906	544.2266	521.5645	(84)

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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	25.3347	25.3957	25.4558	25.7419	25.7961	26.0517	26.0517	26.0995	25.9526	25.7961	25.6866	25.5732	
alpha	2.6890	2.6930	2.6971	2.7161	2.7197	2.7368	2.7368	2.7400	2.7302	2.7197	2.7124	2.7049	
util living area	0.9313	0.8990	0.8493	0.7533	0.6223	0.4718	0.3556	0.3972	0.5911	0.7976	0.9004	0.9380	(86)
MIT	18.8003	19.1477	19.6221	20.2022	20.6312	20.8759	20.9577	20.9421	20.7626	20.1962	19.4140	18.7435	(87)
Th 2	20.3982	20.3996	20.4010	20.4077	20.4089	20.4147	20.4147	20.4158	20.4125	20.4089	20.4064	20.4038	(88)
util rest of house	0.9259	0.8914	0.8380	0.7353	0.5958	0.4359	0.3121	0.3521	0.5552	0.7786	0.8916	0.9331	(89)
MIT 2	18.3263	18.6686	19.1336	19.6975	20.0998	20.3221	20.3883	20.3783	20.2271	19.7016	18.9394	18.2742	(90)
Living area fraction										fLA = Living area / (4) =		0.7182	(91)
MIT	18.6667	19.0127	19.4844	20.0600	20.4814	20.7198	20.7972	20.7832	20.6117	20.0568	19.2803	18.6112	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6667	19.0127	19.4844	20.0600	20.4814	20.7198	20.7972	20.7832	20.6117	20.0568	19.2803	18.6112	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9069	0.8708	0.8185	0.7241	0.5991	0.4548	0.3407	0.3807	0.5677	0.7662	0.8722	0.9150	(94)
Useful gains	495.4409	555.3134	584.2643	585.1300	523.3305	395.8278	283.4229	291.7221	395.5583	465.5528	474.6626	477.2247	(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	1037.5889	1016.7957	933.2965	793.2454	622.8678	429.8192	294.7904	307.2869	459.0872	670.7705	867.6284	1031.1018	(97)
Space heating kWh	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(98a)
Space heating requirement - total per year (kWh/year)												2044.7550	
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	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2044.7550	
Space heating per m2											(98c) / (4) =	34.0792	(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	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(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)	437.0077	335.9871	281.3434	162.3436	80.2338	0.0000	0.0000	0.0000	0.0000	165.4192	306.5389	446.4621	(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												
	184.9930	163.6316	174.3098	154.8330	151.0614	137.2136	136.4080	141.3383	142.3113	157.3377	165.5780	183.2191 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.7589	85.4705	84.9518	83.9864	82.5524	79.8000	79.8000	79.8000	79.8000	83.9925	85.2505	85.8210 (217)
Fuel for water heating, kWh/month												
	215.7130	191.4480	205.1867	184.3549	182.9886	171.9468	170.9373	177.1157	178.3349	187.3237	194.2252	213.4897 (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	18.1251	14.5406	13.0922	9.5919	7.4091	6.0533	6.7588	8.7853	11.4113	14.9722	16.9111	18.6288 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.3644	-20.0802	-30.7417	-36.8942	-41.8650	-39.8548	-39.3792	-36.1378	-30.7964	-23.9676	-15.1287	-11.4151 (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	-4.2060	-9.0924	-18.5350	-28.5302	-38.4071	-38.8331	-38.3675	-32.1636	-23.1627	-13.2165	-5.6836	-3.3075 (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	2215.3358 (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	2273.0645 (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)	146.2796 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-593.1301 (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	4127.5499 (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	2215.3358	0.2100	465.2205	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2273.0645	0.2100	477.3435	(264)
Space and water heating			942.5641	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	146.2796	0.1443	21.1127	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-339.6250	0.1333	-45.2597	
PV Unit electricity exported	-253.5051	0.1252	-31.7364	
Total			-76.9961	(269)
Total CO2, kg/year			898.6099	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.9800	(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	2215.3358	1.1300	2503.3295	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2273.0645	1.1300	2568.5629	(278)
Space and water heating			5071.8924	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	146.2796	1.5338	224.3685	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-339.6250	1.4924	-506.8715	
PV Unit electricity exported	-253.5051	0.4595	-116.4859	
Total			-623.3573	(283)
Total Primary energy kWh/year			4803.0044	(286)
Target Primary Energy Rate (TPER)			80.0500	(287)

Full SAP Calculation Printout

Property Reference	Flat 3 HH - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 3 HH - Be Green	Prop Type Ref	
Property	Flat 1 HH, West Central Street, London, WC1A		

SAP Rating	77 C	DER	6.10	TER	14.98
Environmental	95 A	% DER < TER			59.28
CO_2 Emissions (t/year)	0.33	DFEE	39.94	TFEE	40.44
Compliance Check	See BREL	% DFEE < TFEE			1.23
% DPER < TPER	19.05	DPER	64.80	TPER	80.05

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	60.0000 (1b)	x	2.8600 (2b)	=	171.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 60.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	171.6000	(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		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(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) =	84.6000 (23c)

Effective ac	0.2396	0.2364	0.2332	0.2172	0.2141	0.1981	0.1981	0.1949	0.2045	0.2141	0.2204	0.2268	(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	
Windows (Uw = 0.95)			17.5300	0.9152	16.0438			(27)
Glazed Door (Uw = 0.95)			7.3500	0.9152	6.7269			(27)
Floor			1.8000	0.1200	0.2160			(28b)

External Wall 1	87.9200	24.8800	63.0400	0.1600	10.0864	14.0000	882.5600 (29a)
Shelt Unheated Wall	1.9700		1.9700	0.1600	0.3152	14.0000	27.5800 (29a)
Total net area of external elements Aum(A, m2)			91.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3883		(33)
Sheltered Heated			11.1500	0.0000	0.0000	20.0000	223.0000 (32)
Party Floor 1			58.2000			40.0000	2328.0000 (32d)
Party Ceiling 1			60.0000			30.0000	1800.0000 (32b)
Internal Wall 1			80.6500			9.0000	725.8500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5986.9900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		99.7832	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.1000	0.0500	0.6050
E3 Sill	12.1000	0.0500	0.6050
E4 Jamb	40.0000	0.0500	2.0000
E7 Party floor between dwellings (in blocks of flats)	62.9400	0.0700	4.4058
E16 Corner (normal)	8.5800	0.0900	0.7722
E18 Party wall between dwellings	2.8600	0.0600	0.1716
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.8000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.5596	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	41.9479	(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	13.5659	13.3854	13.2049	12.3024	12.1219	11.2194	11.2194	11.0389	11.5804	12.1219	12.4829	12.8439	(38)
Heat transfer coeff	55.5139	55.3334	55.1529	54.2503	54.0698	53.1673	53.1673	52.9868	53.5283	54.0698	54.4308	54.7919	(39)
Average = Sum(39)m / 12 =												54.2052	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9252	0.9222	0.9192	0.9042	0.9012	0.8861	0.8861	0.8831	0.8921	0.9012	0.9072	0.9132	(40)
HLP (average)												0.9034	
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												1.9816 (42)
Hot water usage for mixer showers	92.1881	90.8027	88.7839	84.9213	82.0708	78.8919	77.0850	79.0885	81.2848	84.6979	88.6435	91.8349 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	34.9239	33.6540	32.3840	31.1140	29.8441	28.5741	28.5741	29.8441	31.1140	32.3840	33.6540	34.9239 (42c)
Average daily hot water use (litres/day)												116.7434 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.1120	124.4567	121.1679	116.0353	111.9148	107.4660	105.6591	108.9326	112.3988	117.0819	122.2975	126.7588	(44)
Energy conte	201.3144	177.2247	186.2306	158.8465	150.6589	132.1420	127.7855	134.8813	138.5990	158.8791	174.2352	198.4737	(45)
Energy content (annual)										Total = Sum(45)m =		1939.2708	
Distribution loss (46)m = 0.15 x (45)m	30.1972	26.5837	27.9346	23.8270	22.5988	19.8213	19.1678	20.2322	20.7898	23.8319	26.1353	29.7711	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6480	(55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(64)
										Total per year (kWh/year) = Sum(64)m =		2449.6868	(64)
12Total per year (kWh/year)												2450	(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	101.6174	90.2514	96.6020	86.3781	84.7744	77.4988	77.1690	79.5284	79.6458	87.5076	91.4948	100.6728	(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	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	87.2319	96.5781	87.2319	90.1396	87.2319	90.1396	87.2319	87.2319	90.1396	87.2319	90.1396	87.2319	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
172.9469 174.7416 170.2191 160.5914 148.4380 137.0156 129.3847 127.5901 132.1125 141.7403 153.8936 165.3161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 32.9082 (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)
-79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 -79.2654 (71)
Water heating gains (Table 5)
136.5825 134.3026 129.8414 119.9696 113.9441 107.6372 103.7218 106.8930 110.6191 117.6178 127.0761 135.3129 (72)
Total internal gains
449.4858 458.3468 440.0169 423.4250 402.3385 387.5169 373.0629 374.4394 385.5958 399.3144 423.8339 440.5854 (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	
Northeast	4.2000	11.2829	0.4700	0.7000	0.7700	10.8044	(75)
Southeast	11.0000	36.7938	0.4700	0.7000	0.7700	92.2777	(77)
Northwest	2.3300	11.2829	0.4700	0.7000	0.7700	5.9939	(81)
Northeast	7.3500	11.2829	0.4700	0.7000	0.7700	18.9077	(75)

Solar gains 127.9837 229.8636 346.0120 481.5286 587.5484 604.4994 573.9795 491.6430 392.4309 262.5422 155.4548 108.1298 (83)
Total gains 577.4695 688.2105 786.0289 904.9537 989.8868 992.0163 947.0424 866.0824 778.0267 661.8566 579.2887 548.7152 (84)

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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	29.9574	30.0552	30.1535	30.6552	30.7575	31.2796	31.2796	31.3862	31.0686	30.7575	30.5535	30.3522	
alpha	2.9972	3.0037	3.0102	3.0437	3.0505	3.0853	3.0853	3.0924	3.0712	3.0505	3.0369	3.0235	
util living area	0.8925	0.8374	0.7571	0.6222	0.4741	0.3346	0.2445	0.2774	0.4481	0.6888	0.8421	0.9034	(86)
Living	19.7580	20.0259	20.3302	20.6387	20.8057	20.8770	20.8938	20.8908	20.8420	20.6019	20.1498	19.7172	
Non living	18.6960	19.0257	19.3946	19.7642	19.9495	20.0333	20.0476	20.0483	19.9978	19.7349	19.1946	18.6536	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3646	20.0259	20.3302	20.6387	20.8057	20.8770	20.8938	20.8908	20.8420	20.6019	20.1498	19.8966	(87)
Th 2	20.1461	20.1487	20.1512	20.1640	20.1665	20.1793	20.1793	20.1819	20.1742	20.1665	20.1614	20.1563	(88)
util rest of house	0.8805	0.8208	0.7343	0.5918	0.4377	0.2939	0.1998	0.2294	0.4007	0.6541	0.8232	0.8924	(89)
MIT 2	19.5680	19.0257	19.3946	19.7642	19.9495	20.0333	20.0476	20.0483	19.9978	19.7349	19.1946	18.9244	(90)
Living area fraction										fLA = Living area / (4) =		0.7182	(91)
MIT	20.1401	19.7440	20.0665	20.3922	20.5644	20.6392	20.6553	20.6534	20.6041	20.3576	19.8806	19.6226	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1401	19.7440	20.0665	20.3922	20.5644	20.6392	20.6553	20.6534	20.6041	20.3576	19.8806	19.6226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8804	0.8122	0.7318	0.6004	0.4553	0.3169	0.2258	0.2572	0.4257	0.6624	0.8163	0.8847	(94)
Useful gains	508.3960	558.9624	575.2543	543.2987	450.7293	314.3331	213.8736	222.7685	331.2350	438.3883	472.8993	485.4282	(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	879.3454	821.3691	748.2329	623.4566	479.2979	321.0886	215.6097	225.3732	348.1519	527.5905	695.6578	845.0347	(97)
Space heating kWh	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98a)
Space heating requirement - total per year (kWh/year)												1154.2882	
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	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1154.2882	
Space heating per m2											(98c) / (4) =	19.2381	(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	499.7729	393.4383	402.6999	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9516	0.9701	0.9603	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	475.5967	381.6936	386.6986	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1113.5185	1063.0499	969.3521	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	459.3037	506.9291	433.4942	0.0000	0.0000	0.0000	0.0000 (104)

Cooled fraction — fC = cooled area / (4) = 0.9117 (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	104.6830	115.5376	98.8006	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling requirement — 319.0211 (107)

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 %) — 169.5759 (206)

Efficiency of main space heating system 2 (in %) — 0.0000 (207)

Efficiency of secondary/supplementary heating system, % — 0.0000 (208)

Cooling System Energy Efficiency Ratio (see Table 10c) — 4.0300 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	275.9863	176.3373	128.6961	57.7137	21.2551	0.0000	0.0000	0.0000	0.0000	66.3664	160.3861	267.5472	(98)
Space heating efficiency (main heating system 1)	169.5759	169.5759	169.5759	169.5759	169.5759	0.0000	0.0000	0.0000	0.0000	169.5759	169.5759	169.5759	(210)
Space heating fuel (main heating system)	162.7509	103.9873	75.8929	34.0341	12.5342	0.0000	0.0000	0.0000	0.0000	39.1367	94.5807	157.7743	(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	244.6648	216.3799	229.5810	200.7985	194.0093	174.0940	171.1359	178.2317	180.5510	202.2295	216.1872	241.8241	(64)
Efficiency of water heater												167.3400	(216)
(217)m	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	167.3400	(217)
Fuel for water heating, kWh/month	146.2082	129.3055	137.1943	119.9943	115.9372	104.0361	102.2684	106.5087	107.8947	120.8494	129.1904	144.5106	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	25.9759	28.6694	24.5163	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	15.4335	13.9400	15.4335	14.9357	15.4335	14.9357	15.4335	15.4335	14.9357	15.4335	14.9357	15.4335	(231)
Lighting	16.0257	12.8564	11.5758	8.4809	6.5509	5.3522	5.9760	7.7678	10.0896	13.2381	14.9524	16.4712	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 — 680.6912 (211)

Space heating fuel - main system 2 — 0.0000 (213)

Space heating fuel - secondary — 0.0000 (215)

Efficiency of water heater — 167.3400

Water heating fuel used — 1463.8979 (219)

Space cooling fuel — 79.1616 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)

mechanical ventilation fans (SFP = 0.8680) — 181.7175 (230a)

Total electricity for the above, kWh/year — 181.7175 (231)

Electricity for lighting (calculated in Appendix L) — 129.3369 (232)

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

PV generation — 0.0000 (233)

Wind generation — 0.0000 (234)

Hydro-electric generation (Appendix N) — 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) — 0.0000 (235)

Appendix Q - special features

Energy saved or generated — -0.0000 (236)

Energy used — 0.0000 (237)

Total delivered energy for all uses — 2534.8052 (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	680.6912	0.1566	106.6209	(261)
Total CO2 associated with community systems			0.0000	(373)

Water heating (other fuel)	1463.8979	0.1410	206.4012 (264)
Space and water heating			313.0221 (265)
Space cooling	79.1616	0.1143	9.0452 (266)
Pumps, fans and electric keep-hot	181.7175	0.1387	25.2065 (267)
Energy for lighting	129.3369	0.1443	18.6673 (268)
Total CO2, kg/year			365.9411 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.1000 (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	680.6912	1.5798	1075.3778	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1463.8979	1.5214	2227.1018	(278)
Space and water heating			3302.4796	(279)
Space cooling	79.1616	1.4211	112.4966	(280)
Pumps, fans and electric keep-hot	181.7175	1.5128	274.9023	(281)
Energy for lighting	129.3369	1.5338	198.3813	(282)
Total Primary energy kWh/year			3888.2598	(286)
Dwelling Primary energy Rate (DPER)			64.8000	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		60.0000 (1b)	x	2.8600 (2b)	=	171.6000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	171.6000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1166	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3666	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3116	(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	0.3972	0.3895	0.3817	0.3427	0.3349	0.2960	0.2960	0.2882	0.3116	0.3349	0.3505	0.3661	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(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 Opening Type (Uw = 1.20)			14.9900	1.1450	17.1641			(27)
Floor			1.8000	0.1300	0.2340			(28b)

External Wall 1	87.9200	14.9900	72.9300	0.1800	13.1274	(29a)
Shelt Unheated Wall	1.9700		1.9700	0.1800	0.3546	(29a)
Total net area of external elements Aum(A, m2)			91.6900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8801	(33)
Sheltered Heated			11.1500	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.7832 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.1000	0.0500	0.6050
E3 Sill	12.1000	0.0500	0.6050
E4 Jamb	40.0000	0.0500	2.0000
E7 Party floor between dwellings (in blocks of flats)	62.9400	0.0700	4.4058
E16 Corner (normal)	8.5800	0.0900	0.7722
E18 Party wall between dwellings	2.8600	0.0600	0.1716
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.8000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5596 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 39.4397 (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	32.7821	32.6086	32.4386	31.6398	31.4903	30.7946	30.7946	30.6657	31.0626	31.4903	31.7926	32.1087	(38)
Heat transfer coeff	72.2219	72.0484	71.8783	71.0795	70.9300	70.2343	70.2343	70.1055	70.5023	70.9300	71.2324	71.5485	(39)

Average = Sum(39)m / 12 = 71.0788

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2037	1.2008	1.1980	1.1847	1.1822	1.1706	1.1706	1.1684	1.1750	1.1822	1.1872	1.1925	(40)
HLP (average)												1.1846	
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 1.9816 (42)

Hot water usage for mixer showers

73.7505	72.6422	71.0271	67.9370	65.6566	63.1135	61.6680	63.2708	65.0278	67.7583	70.9148	73.4679	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

34.9239	33.6540	32.3840	31.1140	29.8441	28.5741	28.5741	29.8441	31.1140	32.3840	33.6540	34.9239	(42c)

Average daily hot water use (litres/day) 99.7445 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6744	106.2961	103.4111	99.0511	95.5007	91.6876	90.2421	93.1149	96.1419	100.1423	104.5688	108.3919	(44)
Energy conte	172.1137	151.3643	158.9390	135.5959	128.5623	112.7406	109.1400	115.2957	118.5525	135.8922	148.9774	169.7154	(45)

Energy content (annual) Total = Sum(45)m = 1656.8892

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

25.8171	22.7046	23.8409	20.3394	19.2843	16.9111	16.3710	17.2944	17.7829	20.3838	22.3466	25.4573	(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

218.7086	193.4500	205.5339	180.6878	175.1572	157.8325	155.7349	161.8906	163.6444	182.4871	194.0692	216.3103	(62)
-33.7157	-29.8184	-31.2241	-25.8548	-24.0957	-20.6189	-19.3269	-20.5522	-21.3331	-25.1494	-28.4912	-33.0913	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

184.9930	163.6316	174.3098	154.8330	151.0614	137.2136	136.4080	141.3383	142.3113	157.3377	165.5780	183.2191	(64)

Total per year (kWh/year) = Sum(64)m = 1892.2348 (64)

12Total per year (kWh/year) 1892 (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

94.5037	83.9972	90.1232	81.1591	80.0229	73.5597	73.5650	75.6117	75.4922	82.4601	85.6085	93.7063	(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	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	99.0817	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

87.2319	96.5781	87.2319	90.1396	87.2319	90.1396	87.2319	87.2319	90.1396	87.2319	90.1396	87.2319	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

172.9469	174.7416	170.2191	160.5914	148.4380	137.0156	129.3847	127.5901	132.1125	141.7403	153.8936	165.3161	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	32.9082	(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)	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	-79.2654	(71)
Water heating gains (Table 5)	127.0211	124.9958	121.1333	112.7210	107.5576	102.1663	98.8777	101.6287	104.8503	110.8334	118.9006	125.9493	(72)
Total internal gains	442.9245	452.0401	434.3088	419.1765	398.9520	382.0460	368.2188	369.1751	379.8269	395.5301	418.6584	434.2218	(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	
Northeast	6.9600	11.2829	0.6300	0.7000	0.7700	23.9996	(75)
Southeast	6.6300	36.7938	0.6300	0.7000	0.7700	74.5522	(77)
Northwest	1.4000	11.2829	0.6300	0.7000	0.7700	4.8275	(81)

Solar gains	103.3793	185.6683	279.4729	388.9107	474.5234	488.2075	463.5614	397.0738	316.9590	212.0605	125.5682	87.3428	(83)
Total gains	546.3037	637.7083	713.7817	808.0872	873.4754	870.2535	831.7801	766.2490	696.7859	607.5906	544.2266	521.5645	(84)

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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	25.3347	25.3957	25.4558	25.7419	25.7961	26.0517	26.0517	26.0995	25.9526	25.7961	25.6866	25.5732	
alpha	2.6890	2.6930	2.6971	2.7161	2.7197	2.7368	2.7368	2.7400	2.7302	2.7197	2.7124	2.7049	
util living area	0.9313	0.8990	0.8493	0.7533	0.6223	0.4718	0.3556	0.3972	0.5911	0.7976	0.9004	0.9380	(86)
MIT	18.8003	19.1477	19.6221	20.2022	20.6312	20.8759	20.9577	20.9421	20.7626	20.1962	19.4140	18.7435	(87)
Th 2	20.3982	20.3996	20.4010	20.4077	20.4089	20.4147	20.4147	20.4158	20.4125	20.4089	20.4064	20.4038	(88)
util rest of house	0.9259	0.8914	0.8380	0.7353	0.5958	0.4359	0.3121	0.3521	0.5552	0.7786	0.8916	0.9331	(89)
MIT 2	18.3263	18.6686	19.1336	19.6975	20.0998	20.3221	20.3883	20.3783	20.2271	19.7016	18.9394	18.2742	(90)
Living area fraction										fLA = Living area / (4) =		0.7182	(91)
MIT	18.6667	19.0127	19.4844	20.0600	20.4814	20.7198	20.7972	20.7832	20.6117	20.0568	19.2803	18.6112	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6667	19.0127	19.4844	20.0600	20.4814	20.7198	20.7972	20.7832	20.6117	20.0568	19.2803	18.6112	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9069	0.8708	0.8185	0.7241	0.5991	0.4548	0.3407	0.3807	0.5677	0.7662	0.8722	0.9150	(94)
Useful gains	495.4409	555.3134	584.2643	585.1300	523.3305	395.8278	283.4229	291.7221	395.5583	465.5528	474.6626	477.2247	(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	1037.5889	1016.7957	933.2965	793.2454	622.8678	429.8192	294.7904	307.2869	459.0872	670.7705	867.6284	1031.1018	(97)
Space heating kWh	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(98a)
Space heating requirement - total per year (kWh/year)												2044.7550	
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	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2044.7550	
Space heating per m2											(98c) / (4) =	34.0792	(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	403.3581	310.1161	259.6800	149.8431	74.0558	0.0000	0.0000	0.0000	0.0000	152.6819	282.9354	412.0845	(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)	437.0077	335.9871	281.3434	162.3436	80.2338	0.0000	0.0000	0.0000	0.0000	165.4192	306.5389	446.4621	(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												
	184.9930	163.6316	174.3098	154.8330	151.0614	137.2136	136.4080	141.3383	142.3113	157.3377	165.5780	183.2191 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.7589	85.4705	84.9518	83.9864	82.5524	79.8000	79.8000	79.8000	79.8000	83.9925	85.2505	85.8210 (217)
Fuel for water heating, kWh/month												
	215.7130	191.4480	205.1867	184.3549	182.9886	171.9468	170.9373	177.1157	178.3349	187.3237	194.2252	213.4897 (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	18.1251	14.5406	13.0922	9.5919	7.4091	6.0533	6.7588	8.7853	11.4113	14.9722	16.9111	18.6288 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.3644	-20.0802	-30.7417	-36.8942	-41.8650	-39.8548	-39.3792	-36.1378	-30.7964	-23.9676	-15.1287	-11.4151 (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	-4.2060	-9.0924	-18.5350	-28.5302	-38.4071	-38.8331	-38.3675	-32.1636	-23.1627	-13.2165	-5.6836	-3.3075 (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	2215.3358 (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	2273.0645 (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)	146.2796 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-593.1301 (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	4127.5499 (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	2215.3358	0.2100	465.2205	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2273.0645	0.2100	477.3435	(264)
Space and water heating			942.5641	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	146.2796	0.1443	21.1127	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-339.6250	0.1333	-45.2597	
PV Unit electricity exported	-253.5051	0.1252	-31.7364	
Total			-76.9961	(269)
Total CO2, kg/year			898.6099	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.9800	(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	2215.3358	1.1300	2503.3295	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2273.0645	1.1300	2568.5629	(278)
Space and water heating			5071.8924	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	146.2796	1.5338	224.3685	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-339.6250	1.4924	-506.8715	
PV Unit electricity exported	-253.5051	0.4595	-116.4859	
Total			-623.3573	(283)
Total Primary energy kWh/year			4803.0044	(286)
Target Primary Energy Rate (TPER)			80.0500	(287)

Full SAP Calculation Printout

Property Reference	Flat 4 HH - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 4 HH-Gree Unheated Corrid	Prop Type Ref	
Property	Flat 1 HH, West Central Street, London, WC1A		

SAP Rating	77 C	DER	4.74	TER	13.65
Environmental	95 A	% DER < TER			65.27
CO_2 Emissions (t/year)	0.54	DFEE	46.47	TFEE	49.71
Compliance Check	See BREL	% DFEE < TFEE			6.52
% DPER < TPER	30.85	DPER	50.05	TPER	72.37

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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		64.0800 (1b)	x	2.8600 (2b)	=	183.2688 (1b)	-
First floor		62.3200 (1c)	x	3.1500 (2c)	=	196.3080 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	126.4000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	379.5768	(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		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(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) =	83.7000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2441	0.2409	0.2377	0.2217	0.2186	0.2026	0.2026	0.1994	0.2090	0.2186	0.2249	0.2313	(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	
Windows (Uw = 0.95)			22.8600	0.9152	20.9220			(27)
Glazed Door (Uw = 0.95)			5.7500	0.9152	5.2625			(27)

Curtain Wall (Uw = 1.40)			36.3200	1.3258	48.1515		(27)
Solid Door			1.8700	0.8000	1.4960		(26)
External Wall 1	130.2300	28.6100	101.6200	0.1600	16.2592	14.0000	1422.6799 (29a)
Curtain Wall	36.5000	36.3200	0.1800	0.1600	0.0288	0.0000	0.0000 (29a)
Corridor Wall	16.6400	1.8700	14.7700	0.1600	2.3632	14.0000	206.7800 (29a)
Terrace	14.6300		14.6300	0.1000	1.4630	9.0000	131.6700 (30)
Green Roof	62.3200		62.3200	0.1000	6.2320	9.0000	560.8800 (30)
Total net area of external elements Aum(A, m2)			260.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.1782		(33)
Party Floor 1			64.0800			40.0000	2563.2000 (32d)
Internal Wall 1			164.7300			9.0000	1482.5700 (32c)
Internal Floor 1			62.3200			20.0000	1246.4000 (32d)
Internal Ceiling 1			64.0800			20.0000	1281.6000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8895.7799 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 70.3780 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500
E3 Sill	13.0000	0.0500	0.6500
E4 Jamb	41.0000	0.0500	2.0500
E6 Intermediate floor within a dwelling	18.3700	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	37.8400	0.0700	2.6488
E15 Flat roof with parapet	56.1400	0.1560	8.7578
E16 Corner (normal)	8.8200	0.0900	0.7938
E16 Corner (normal)	15.7500	0.0900	1.4175
E18 Party wall between dwellings	5.6800	0.0600	0.3408
E17 Corner (inverted – internal area greater than external area)	9.1400	-0.0900	-0.8226

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.4861 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 118.6643 (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	30.5714	30.1721	29.7728	27.7765	27.3772	25.3809	25.3809	24.9816	26.1794	27.3772	28.1757	28.9743	(38)
Heat transfer coeff	149.2357	148.8364	148.4372	146.4408	146.0416	144.0452	144.0452	143.6460	144.8438	146.0416	146.8401	147.6386	(39)
Average = Sum(39)m / 12 =												146.3410	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1807	1.1775	1.1743	1.1586	1.1554	1.1396	1.1396	1.1364	1.1459	1.1554	1.1617	1.1680	(40)
HLP (average)												1.1578	
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 2.8850 (42)
Hot water usage for mixer showers

72.5919	71.5010	69.9113	66.8698	64.6252	62.1220	60.6992	62.2769	64.0063	66.6939	69.8008	72.3138	(42a)

Hot water usage for baths

31.3401	30.8747	30.2192	29.0107	28.1058	27.1024	26.5604	27.2112	27.9199	28.9936	30.2270	31.2342	(42b)

Hot water usage for other uses

44.1754	42.5690	40.9626	39.3562	37.7498	36.1435	36.1435	37.7498	39.3562	40.9626	42.5690	44.1754	(42c)

Average daily hot water use (litres/day) 136.1439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.1074	144.9446	141.0931	135.2367	130.4808	125.3678	123.4031	127.2379	131.2824	136.6501	142.5967	147.7233	(44)
Energy conte	234.5659	206.3992	216.8549	185.1323	175.6522	154.1544	149.2453	157.5471	161.8843	185.4328	203.1552	231.2990	(45)
Energy content (annual)										Total = Sum(45)m =		2261.3227	
Distribution loss (46)m = 0.15 x (45)m	35.1849	30.9599	32.5282	27.7698	26.3478	23.1232	22.3868	23.6321	24.2826	27.8149	30.4733	34.6948	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.2000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.6480 (55)
Total storage loss

20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)

If cylinder contains dedicated solar storage

20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(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

277.9163	245.5544	260.2053	227.0843	219.0026	196.1064	192.5957	200.8975	203.8363	228.7832	245.1072	274.6494	(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

277.9163	245.5544	260.2053	227.0843	219.0026	196.1064	192.5957	200.8975	203.8363	228.7832	245.1072	274.6494	(64)

Total per year (kWh/year) = Sum(64)m = 2771.7387 (64)
12Total per year (kWh/year) 2772 (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

112.6735	99.9519	106.7846	95.1181	93.0847	84.8179	84.3044	87.0647	87.3881	96.3367	101.1107	111.5872	(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	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	147.9499	163.8016	147.9499	152.8815	147.9499	152.8815	147.9499	147.9499	152.8815	147.9499	152.8815	147.9499	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	293.3272	296.3710	288.7006	272.3714	251.7587	232.3857	219.4433	216.3995	224.0699	240.3991	261.0118	280.3848	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	(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)

	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	(71)

Water heating gains (Table 5)

	151.4428	148.7380	143.5277	132.1084	125.1138	117.8027	113.3123	117.0225	121.3724	129.4849	140.4315	149.9828	(72)

Total internal gains

	658.9950	675.1857	646.4533	623.6365	591.0975	569.3450	546.9807	547.6470	564.5989	584.1089	620.5999	644.5926	(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	
Northeast	4.0000	11.2829	0.4700	0.7000	0.7700	10.2899	(75)
Southeast	14.2100	36.7938	0.4700	0.7000	0.7700	119.2060	(77)
Northwest	4.6500	11.2829	0.4700	0.7000	0.7700	11.9620	(81)
Southeast	5.7500	36.7938	0.4700	0.7000	0.7700	48.2361	(77)
Southeast	23.3100	36.7938	0.4700	1.0000	0.7700	279.3498	(77)
Southwest	13.0100	36.7938	0.4700	1.0000	0.7700	155.9134	(79)

Solar gains	624.9572	1071.9246	1486.2863	1874.4876	2129.6181	2127.4295	2045.5710	1853.2123	1620.4099	1189.9984	749.9007	533.9622	(83)
Total gains	1283.9522	1747.1103	2132.7396	2498.1241	2720.7156	2696.7745	2592.5516	2400.8593	2185.0088	1774.1073	1370.5007	1178.5548	(84)

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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	16.5580	16.6025	16.6471	16.8741	16.9202	17.1547	17.1547	17.2024	17.0601	16.9202	16.8282	16.7372	
alpha	2.1039	2.1068	2.1098	2.1249	2.1280	2.1436	2.1436	2.1468	2.1373	2.1280	2.1219	2.1158	
util living area	0.8623	0.7773	0.6815	0.5583	0.4349	0.3185	0.2353	0.2625	0.4064	0.6262	0.8017	0.8794	(86)
Living	18.8421	19.3446	19.8374	20.3034	20.5999	20.7649	20.8230	20.8130	20.6932	20.2577	19.4760	18.7463	
Non living	17.4420	18.0535	18.6454	19.1980	19.5311	19.7139	19.7664	19.7618	19.6445	19.1672	18.2366	17.3299	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8961	19.3446	19.8374	20.3034	20.5999	20.7649	20.8230	20.8130	20.6932	20.2577	19.4760	19.0616	(87)
Th 2	19.9355	19.9380	19.9406	19.9533	19.9559	19.9686	19.9686	19.9712	19.9635	19.9559	19.9508	19.9457	(88)
util rest of house	0.8483	0.7575	0.6555	0.5257	0.3958	0.2724	0.1830	0.2075	0.3554	0.5882	0.7801	0.8668	(89)
MIT 2	18.9363	18.0535	18.6454	19.1980	19.5311	19.7139	19.7664	19.7618	19.6445	19.1672	18.2366	17.7995	(90)
Living area fraction										fLA = Living area / (4) =		0.3052	(91)
MIT	19.2293	18.4476	19.0092	19.5354	19.8573	20.0347	20.0889	20.0826	19.9646	19.5001	18.6149	18.1847	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2293	18.4476	19.0092	19.5354	19.8573	20.0347	20.0889	20.0826	19.9646	19.5001	18.6149	18.1847	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8378	0.7253	0.6304	0.5120	0.3919	0.2755	0.1892	0.2136	0.3555	0.5702	0.7477	0.8413	(94)
Useful gains	1075.6891	1267.1386	1344.4857	1278.9504	1066.3548	742.8268	490.4612	512.8232	776.7734	1011.6477	1024.7820	991.5037	(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	2227.9810	2016.3752	1856.8343	1557.4563	1191.3049	782.8436	502.5581	528.9973	849.4458	1299.7780	1690.8488	2064.6876	(97)
Space heating kWh	857.3052	503.4870	381.1874	200.5243	92.9629	0.0000	0.0000	0.0000	0.0000	214.3689	479.5681	798.4488	(98a)
Space heating requirement - total per year (kWh/year)												3527.8525	
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	857.3052	503.4870	381.1874	200.5243	92.9629	0.0000	0.0000	0.0000	0.0000	214.3689	479.5681	798.4488	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3527.8525	
Space heating per m2											(98c) / (4) =	27.9102	(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	1354.0251	1065.9346	1091.7092	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8956	0.9252	0.9114	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1212.6878	986.1686	994.9510	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3074.8647	2956.2416	2734.0460	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	1340.7673	1465.7343	1293.8867	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	0.7248	(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	242.9610	265.6064	234.4658	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												743.0332	(107)

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 %)	219.2189	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Cooling System Energy Efficiency Ratio (see Table 10c)	4.0300	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	857.3052	503.4870	381.1874	200.5243	92.9629	0.0000	0.0000	0.0000	0.0000	214.3689	479.5681	798.4488	(98)
Space heating efficiency (main heating system 1)													
	219.2189	219.2189	219.2189	219.2189	219.2189	0.0000	0.0000	0.0000	0.0000	219.2189	219.2189	219.2189	(210)
Space heating fuel (main heating system)													
	391.0727	229.6732	173.8844	91.4722	42.4064	0.0000	0.0000	0.0000	0.0000	97.7876	218.7622	364.2244	(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													
	277.9163	245.5544	260.2053	227.0843	219.0026	196.1064	192.5957	200.8975	203.8363	228.7832	245.1072	274.6494	(64)
Efficiency of water heater												163.5136	(216)
(217)m	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	163.5136	(217)
Fuel for water heating, kWh/month													
	169.9653	150.1738	159.1338	138.8779	133.9355	119.9328	117.7858	122.8629	124.6602	139.9170	149.9002	167.9674	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	60.2881	65.9073	58.1801	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	34.1388	30.8350	34.1388	33.0375	34.1388	33.0375	34.1388	34.1388	33.0375	34.1388	33.0375	34.1388	(231)
Lighting	27.1805	21.8052	19.6332	14.3841	11.1107	9.0775	10.1356	13.1746	17.1125	22.4525	25.3600	27.9359	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1609.2831	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	163.5136	
Water heating fuel used	1695.1125	(219)
Space cooling fuel	184.3755	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)		
mechanical ventilation fans (SFP = 0.8680)	401.9567	(230a)
Total electricity for the above, kWh/year	401.9567	(231)
Electricity for lighting (calculated in Appendix L)	219.3623	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4110.0901	(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	1609.2831	0.1563	251.4758	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1695.1125	0.1411	239.0963	(264)
Space and water heating			490.5721	(265)
Space cooling	184.3755	0.1143	21.0665	(266)
Pumps, fans and electric keep-hot	401.9567	0.1387	55.7563	(267)
Energy for lighting	219.3623	0.1443	31.6608	(268)
Total CO2, kg/year			599.0557	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7400	(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	1609.2831	1.5784	2540.1494	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1695.1125	1.5216	2579.2167	(278)
Space and water heating			5119.3661	(279)
Space cooling	184.3755	1.4211	262.0129	(280)
Pumps, fans and electric keep-hot	401.9567	1.5128	608.0800	(281)
Energy for lighting	219.3623	1.5338	336.4652	(282)
Total Primary energy kWh/year			6325.9242	(286)
Dwelling Primary energy Rate (DPER)			50.0500	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.0800 (1b)	x	2.8600 (2b)	=	183.2688 (1b)	-
First floor	62.3200 (1c)	x	3.1500 (2c)	=	196.3080 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 126.4000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	379.5768	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1054	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3554	(18)
Number of sides sheltered		2	(19)
Shelter factor (20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20)	=	0.3021	(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	0.3851	0.3776	0.3700	0.3323	0.3247	0.2870	0.2870	0.2794	0.3021	0.3247	0.3398	0.3549	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5527	0.5412	0.5412	0.5390	0.5456	0.5527	0.5577	0.5630	(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			1.8700	1.0000	1.8700			(26)
TER Opening Type (Uw = 1.20)			13.0900	1.1450	14.9885			(27)
TER Opening Type Curtain (Uw = 1.30)			16.6300	1.2357	20.5504			(27)
External Wall 1	130.2300	13.0900	117.1400	0.1800	21.0852			(29a)
Curtain Wall	36.5000	16.6300	19.8700	0.1800	3.5766			(29a)
Corridor Wall	16.6400	1.8700	14.7700	0.1800	2.6586			(29a)
Terrace	14.6300		14.6300	0.1100	1.6093			(30)
Green Roof	62.3200		62.3200	0.1100	6.8552			(30)
Total net area of external elements Aum(A, m2)			260.3200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.1938			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 70.3780 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.0000	0.0500	0.6500
E3 Sill	13.0000	0.0500	0.6500
E4 Jamb	41.0000	0.0500	2.0500
E6 Intermediate floor within a dwelling	18.3700	0.0000	0.0000
E7 Party floor between dwellings (in blocks of flats)	37.8400	0.0700	2.6488
E15 Flat roof with parapet	56.1400	0.5600	31.4384
E16 Corner (normal)	8.8200	0.0900	0.7938
E16 Corner (normal)	15.7500	0.0900	1.4175
E18 Party wall between dwellings	5.6800	0.0600	0.3408
E17 Corner (inverted – internal area greater than external area)	9.1400	-0.0900	-0.8226

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 39.1667 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 112.3605 (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	71.9205	71.5597	71.2061	69.5452	69.2345	67.7879	67.7879	67.5200	68.3451	69.2345	69.8631	70.5203	(38)
Heat transfer coeff	184.2810	183.9202	183.5666	181.9057	181.5950	180.1484	180.1484	179.8805	180.7056	181.5950	182.2236	182.8808	(39)

Average = Sum(39)m / 12 = 181.9042

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4579	1.4551	1.4523	1.4391	1.4367	1.4252	1.4252	1.4231	1.4296	1.4367	1.4416	1.4468	(40)
HLP (average)												1.4391	
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 2.8850 (42)

Hot water usage for mixer showers	72.5919	71.5010	69.9113	66.8698	64.6252	62.1220	60.6992	62.2769	64.0063	66.6939	69.8008	72.3138 (42a)
Hot water usage for baths	31.3401	30.8747	30.2192	29.0107	28.1058	27.1024	26.5604	27.2112	27.9199	28.9936	30.2270	31.2342 (42b)
Hot water usage for other uses	44.1754	42.5690	40.9626	39.3562	37.7498	36.1435	36.1435	37.7498	39.3562	40.9626	42.5690	44.1754 (42c)

Average daily hot water use (litres/day) 136.1439 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.1074	144.9446	141.0931	135.2367	130.4808	125.3678	123.4031	127.2379	131.2824	136.6501	142.5967	147.7233	(44)
Energy conte	234.5659	206.3992	216.8549	185.1323	175.6522	154.1544	149.2453	157.5471	161.8843	185.4328	203.1552	231.2990	(45)

Energy content (annual) Total = Sum(45)m = 2261.3227

Distribution loss (46)m = 0.15 x (45)m	35.1849	30.9599	32.5282	27.7698	26.3478	23.1232	22.3868	23.6321	24.2826	27.8149	30.4733	34.6948 (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	281.1608	248.4850	263.4498	230.2241	222.2471	199.2462	195.8402	204.1420	206.9761	232.0278	248.2470	277.8939 (62)
WWHRS	-33.1860	-29.3500	-30.7336	-25.4486	-23.7172	-20.2950	-19.0233	-20.2294	-20.9980	-24.7543	-28.0436	-32.5714 (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	247.9748	219.1350	232.7162	204.7755	198.5299	178.9512	176.8169	183.9127	185.9782	207.2735	220.2034	245.3225 (64)

Total per year (kWh/year) = Sum(64)m = 2501.5897 (64)

12Total per year (kWh/year) 2502 (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

	115.2691	102.2963	109.3802	97.6300	95.6803	87.3298	86.9000	89.6603	89.9000	98.9323	103.6226	114.1828 (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	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	144.2503	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	147.9499	163.8016	147.9499	152.8815	147.9499	152.8815	147.9499	147.9499	152.8815	147.9499	152.8815	147.9499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	293.3272	296.3710	288.7006	272.3714	251.7587	232.3857	219.4433	216.3995	224.0699	240.3991	261.0118	280.3848	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	37.4250	(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)													
	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	-115.4003	(71)
Water heating gains (Table 5)													
	154.9316	152.2267	147.0164	135.5972	128.6025	121.2914	116.8011	120.5112	124.8611	132.9736	143.9202	153.4716	(72)
Total internal gains													
	665.4837	681.6744	652.9420	630.1252	597.5862	572.8337	550.4694	551.1357	568.0876	590.5976	627.0886	651.0813	(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	
Northeast	1.8300	11.2829	0.6300	0.7000	0.7700	6.3102	(75)
Southeast	9.1300	36.7938	0.6300	0.7000	0.7700	102.6639	(77)
Northwest	2.1300	11.2829	0.6300	0.7000	0.7700	7.3447	(81)
Southeast	10.6700	36.7938	0.6300	0.7000	0.7700	119.9807	(77)
Southwest	5.9600	36.7938	0.6300	0.7000	0.7700	67.0183	(79)

Solar gains	303.3177	521.1979	725.1731	918.7179	1047.4721	1048.0048	1007.0145	909.7186	792.0060	579.2830	364.1307	259.0423	(83)
Total gains	968.8014	1202.8723	1378.1151	1548.8431	1645.0584	1620.8385	1557.4839	1460.8543	1360.0936	1169.8806	991.2193	910.1236	(84)

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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	13.4091	13.4354	13.4613	13.5842	13.6075	13.7167	13.7167	13.7372	13.6745	13.6075	13.5605	13.5118	
alpha	1.8939	1.8957	1.8974	1.9056	1.9072	1.9144	1.9144	1.9158	1.9116	1.9072	1.9040	1.9008	
util living area													
	0.9204	0.8838	0.8376	0.7629	0.6646	0.5414	0.4292	0.4643	0.6277	0.7969	0.8908	0.9282	(86)
MIT	17.2162	17.7106	18.3846	19.2220	19.9603	20.5169	20.7822	20.7381	20.3116	19.3303	18.1252	17.1267	(87)
Th 2	19.7192	19.7214	19.7235	19.7335	19.7353	19.7440	19.7440	19.7457	19.7407	19.7353	19.7316	19.7276	(88)
util rest of house													
	0.9101	0.8693	0.8168	0.7313	0.6161	0.4673	0.3284	0.3641	0.5590	0.7625	0.8747	0.9189	(89)
MIT 2	15.4443	16.0513	16.8767	17.8899	18.7538	19.3693	19.6226	19.5906	19.1686	18.0465	16.5788	15.3356	(90)
Living area fraction										fLA = Living area / (4) =		0.3052	(91)
MIT	15.9851	16.5577	17.3370	18.2965	19.1220	19.7196	19.9766	19.9408	19.5174	18.4384	17.0508	15.8823	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9851	16.5577	17.3370	18.2965	19.1220	19.7196	19.9766	19.9408	19.5174	18.4384	17.0508	15.8823	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8655	0.8194	0.7662	0.6876	0.5891	0.4657	0.3485	0.3810	0.5452	0.7181	0.8264	0.8762	(94)
Useful gains	838.4741	985.6005	1055.8666	1065.0302	969.1161	754.8550	542.7710	556.5540	741.4807	840.0688	819.1373	797.4659	(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													
	2153.3456	2144.0945	1989.3034	1709.2750	1347.8027	922.2863	608.2831	636.9277	978.9623	1423.4065	1813.2758	2136.4695	(97)
Space heating kWh													
	978.2644	778.5080	694.4770	463.8563	281.7428	0.0000	0.0000	0.0000	0.0000	434.0033	715.7797	996.2187	(98a)
Space heating requirement - total per year (kWh/year)												5342.8501	
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													
	978.2644	778.5080	694.4770	463.8563	281.7428	0.0000	0.0000	0.0000	0.0000	434.0033	715.7797	996.2187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5342.8501	
Space heating per m2											(98c) / (4) =	42.2694	(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													
	978.2644	778.5080	694.4770	463.8563	281.7428	0.0000	0.0000	0.0000	0.0000	434.0033	715.7797	996.2187	(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)													
	1059.8747	843.4539	752.4128	502.5529	305.2468	0.0000	0.0000	0.0000	0.0000	470.2094	775.4926	1079.3268	(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													
	247.9748	219.1350	232.7162	204.7755	198.5299	178.9512	176.8169	183.9127	185.9782	207.2735	220.2034	245.3225	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8199	86.6533	86.3555	85.8352	84.8445	79.8000	79.8000	79.8000	79.8000	85.6768	86.5047	86.8642	(217)
Fuel for water heating, kWh/month													
	285.6198	252.8869	269.4862	238.5682	233.9927	224.2497	221.5751	230.4670	233.0553	241.9249	254.5566	282.4206	(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	30.7411	24.6616	22.2051	16.2684	12.5662	10.2667	11.4633	14.9004	19.3541	25.3937	28.6821	31.5954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.1079	-40.1707	-60.6454	-71.7053	-80.3729	-76.0907	-75.1160	-69.3737	-59.8215	-47.4254	-30.4727	-23.2109	(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	-9.9070	-21.2861	-43.1641	-66.1220	-88.7337	-89.6787	-88.6703	-74.5145	-53.8522	-30.9092	-13.3718	-7.8046	(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												5788.5700	(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												2968.8030	(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)												248.0980	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1249.5274	(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												7841.9436	(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	5788.5700	0.2100	1215.5997	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2968.8030	0.2100	623.4486	(264)
Space and water heating			1839.0483	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	248.0980	0.1443	35.8082	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-661.5131	0.1336	-88.3592	
PV Unit electricity exported	-588.0142	0.1253	-73.6832	
Total			-162.0424	(269)
Total CO2, kg/year			1724.7434	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6500	(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	5788.5700	1.1300	6541.0841	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2968.8030	1.1300	3354.7474	(278)
Space and water heating			9895.8315	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	248.0980	1.5338	380.5409	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-661.5131	1.4936	-988.0357	
PV Unit electricity exported	-588.0142	0.4599	-270.4506	
Total			-1258.4863	(283)
Total Primary energy kWh/year			9147.9869	(286)
Target Primary Energy Rate (TPER)			72.3700	(287)

Full SAP Calculation Printout

Property Reference	Flat 101 VL - Be Green.	Issued on Date	06/05/2023
Assessment Reference	Flat 101 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	84 B	DER	2.90	TER	14.40
Environmental	97 A	% DER < TER			79.86
CO_2 Emissions (t/year)	0.23	DFEE	36.82	TFEE	43.28
Compliance Check	See BREL	% DFEE < TFEE			14.94
% DPER < TPER	59.83	DPER	30.78	TPER	76.63

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	88.0000 (1b)	x	2.5800 (2b)	=	227.0400 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.0400	(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) =	83.7000 (23c)

Effective ac	0.2297	0.2268	0.2239	0.2094	0.2065	0.1919	0.1919	0.1890	0.1977	0.2065	0.2123	0.2181	(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	
Glazed Door (Uw = 0.95)			13.2600	0.9152	12.1358			(27)
Window (Uw = 0.95)			3.6000	0.9152	3.2948			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			88.0000	0.1200	10.5600	30.0000	2640.0000	(28b)
External Wall 1	93.2700	18.7500	74.5200	0.1500	11.1780	14.0000	1043.2800	(29a)
Total net area of external elements Aum(A, m2)			181.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.6806			(33)
Party Wall 1			13.6700	0.0000	0.0000	20.0000	273.4000	(32)
Party Ceiling 1			88.0000			30.0000	2640.0000	(32b)
Internal Wall 1			103.6100			9.0000	932.4900	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7529.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.5587 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	36.1500	0.0700	2.5305
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9800	0.4430	2.6491
E20 Exposed floor (normal)	36.1500	0.1250	4.5187
E16 Corner (normal)	10.3200	0.0900	0.9288
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	2.5800	0.0600	0.1548
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	5.3000	0.1600	0.8480
E1 Steel lintel with perforated steel base plate	10.1000	0.0500	0.5050
E3 Sill	9.2000	0.0500	0.4600
E4 Jamb	24.2000	0.0500	1.2100

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.5728 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.2534 (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	17.2113	16.9935	16.7758	15.6870	15.4693	14.3806	14.3806	14.1628	14.8161	15.4693	15.9048	16.3403	(38)
Heat transfer coeff	69.4647	69.2469	69.0292	67.9405	67.7227	66.6340	66.6340	66.4163	67.0695	67.7227	68.1582	68.5937	(39)
Average = Sum(39)m / 12 =												67.8860	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7894	0.7869	0.7844	0.7721	0.7696	0.7572	0.7572	0.7547	0.7622	0.7696	0.7745	0.7795	(40)
HLP (average)												0.7714	
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												2.5973 (42)
Hot water usage for mixer showers	67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090 (42a)
Hot water usage for baths	29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670 (42b)
Hot water usage for other uses	41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294 (42c)
Average daily hot water use (litres/day)												127.0959 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)
Energy content (annual)										Total = Sum(45)m =		2111.0357	
Distribution loss (46)m = 0.15 x (45)m	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024	(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	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024	(64)
										Total per year (kWh/year) = Sum(64)m =		2848.9927	(64)
12Total per year (kWh/year)												2849	(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	122.9503	109.3551	117.4530	105.9887	104.6636	96.3732	96.4667	99.0436	98.7724	107.6993	111.5829	121.9362	(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	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.1473	133.0203	120.1473	124.1522	120.1473	124.1522	120.1473	120.1473	124.1522	120.1473	124.1522	120.1473	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(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)													
	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)													
	165.2558	162.7308	157.8669	147.2066	140.6768	133.8516	129.6596	133.1231	137.1838	144.7571	154.9763	163.8928	(72)
Total internal gains													
	582.7130	595.5032	571.6121	551.8550	524.7819	506.4177	487.8365	488.8578	503.0777	519.7477	550.5103	570.9658	(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	
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175	(75)
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100	(77)
Southwest	3.6000	36.7938	0.4700	0.7000	0.7700	30.2000	(79)

Solar gains	75.8275	138.8007	215.5147	309.9451	386.3324	400.7674	379.2127	319.5904	247.8007	160.3072	92.5791	63.7568	(83)
Total gains	658.5405	734.3039	787.1268	861.8001	911.1143	907.1850	867.0492	808.4482	750.8784	680.0549	643.0894	634.7225	(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	30.1079	30.2026	30.2978	30.7834	30.8823	31.3869	31.3869	31.4898	31.1831	30.8823	30.6850	30.4902	
alpha	3.0072	3.0135	3.0199	3.0522	3.0588	3.0925	3.0925	3.0993	3.0789	3.0588	3.0457	3.0327	
util living area													
	0.9121	0.8807	0.8331	0.7352	0.6024	0.4448	0.3302	0.3662	0.5544	0.7667	0.8753	0.9191	(86)
MIT	19.3554	19.6220	19.9829	20.4415	20.7600	20.9316	20.9795	20.9717	20.8617	20.4574	19.8621	19.3198	(87)
Th 2	20.2626	20.2647	20.2669	20.2776	20.2798	20.2906	20.2906	20.2927	20.2863	20.2798	20.2755	20.2712	(88)
util rest of house													
	0.9033	0.8691	0.8170	0.7109	0.5682	0.4011	0.2795	0.3134	0.5089	0.7396	0.8614	0.9108	(89)
MIT 2	18.3234	18.6567	19.1051	19.6680	20.0386	20.2320	20.2768	20.2729	20.1610	19.6992	18.9690	18.2847	(90)
Living area fraction										fLA = Living area / (4) =		0.5440	(91)
MIT	18.8848	19.1818	19.5826	20.0888	20.4310	20.6126	20.6591	20.6530	20.5422	20.1116	19.4548	18.8478	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8848	19.1818	19.5826	20.0888	20.4310	20.6126	20.6591	20.6530	20.5422	20.1116	19.4548	18.8478	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8834	0.8494	0.8002	0.7041	0.5756	0.4212	0.3060	0.3405	0.5256	0.7328	0.8434	0.8915	(94)
Useful gains	581.7763	623.7481	629.8913	606.8259	524.4174	382.1224	265.3560	275.3114	394.6880	498.3594	542.4009	565.8671	(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													
	1013.1274	988.9700	903.0829	760.1699	591.2866	400.6421	270.4717	282.4687	432.0735	644.1545	842.0824	1004.7440	(97)
Space heating kWh													
	320.9253	245.4291	203.2545	110.4077	49.7507	0.0000	0.0000	0.0000	0.0000	108.4716	215.7707	326.5244	(98a)
Space heating requirement - total per year (kWh/year)												1580.5338	
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													
	320.9253	245.4291	203.2545	110.4077	49.7507	0.0000	0.0000	0.0000	0.0000	108.4716	215.7707	326.5244	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1580.5338	
Space heating per m2											(98c) / (4) =	17.9606	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	320.9253	245.4291	203.2545	110.4077	49.7507	0.0000	0.0000	0.0000	0.0000	108.4716	215.7707	326.5244	(98)

Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00

307a	320.9253	245.4291	203.2545	110.4077	49.7507	0.0000	0.0000	0.0000	0.0000	108.4716	215.7707	326.5244
Space heating requirement												
	320.9253	245.4291	203.2545	110.4077	49.7507	0.0000	0.0000	0.0000	0.0000	108.4716	215.7707	326.5244 (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												
	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024
Water heating fuel												
	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (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	23.3369	21.0785	23.3369	22.5841	23.3369	22.5841	23.3369	23.3369	22.5841	23.3369	22.5841	23.3369 (331)
Lighting	22.2640	17.8610	16.0818	11.7822	9.1009	7.4355	8.3022	10.7915	14.0171	18.3912	20.7728	22.8827 (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	1580.5338 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	2848.9927 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	15.8053 (313)
Space cooling fuel	0.0000 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)	
mechanical ventilation fans (SFP = 0.9920)	274.7729 (330a)
Total electricity for the above, kWh/year	274.7729 (331)
Electricity for lighting (calculated in Appendix L)	179.6829 (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	4883.9824 (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			350.0000	(367)
Space and Water heating from Heat pump	1265.5790	0.1554	70.1685	(367)
Electrical energy for heat distribution (space & water)	15.8053	0.0000	6.4683	(372)
Overall CO2 factor for heat network			0.0432	(386)
Total CO2 associated with community systems			191.2769	(373)
Space and water heating			191.2769	(376)
Pumps, fans and electric keep-hot	274.7729	0.1387	38.1144	(378)
Energy for lighting	179.6829	0.1443	25.9338	(379)
Total CO2, kg/year			255.3251	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9000	(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			350.0000	(467a)
Space and Water heating from Heat pump	1265.5790	1.5753	711.3583	(467)
Electrical energy for heat distribution (space & water)	15.8053	0.0000	68.2238	(472)
Overall CO2 factor for heat network			0.4555	(486)
Total CO2 associated with community systems			2017.4749	(473)
Space and water heating			2017.4749	(476)
Pumps, fans and electric keep-hot	274.7729	1.5128	415.6764	(478)
Energy for lighting	179.6829	1.5338	275.6036	(479)
Total Primary energy kWh/year			2708.7549	(483)
Dwelling Primary energy Rate (DPER)			30.7800	(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	88.0000 (1b)	x	2.5800 (2b)	=	227.0400 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 88.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.0400	(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) =	0.1321	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3821	(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) =	0.2962	(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	0.3776	0.3702	0.3628	0.3258	0.3184	0.2813	0.2813	0.2739	0.2962	0.3184	0.3332	0.3480	(22b)
Effective ac	0.5713	0.5685	0.5658	0.5531	0.5507	0.5396	0.5396	0.5375	0.5439	0.5507	0.5555	0.5605	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			16.8600	1.1450	19.3053			(27)
Heatloss Floor 1			88.0000	0.1300	11.4400			(28b)
External Wall 1	93.2700	18.7500	74.5200	0.1800	13.4136			(29a)
Total net area of external elements Aum(A, m2)			181.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.0489			(33)
Party Wall 1			13.6700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 95.5587 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	36.1500	0.0700	2.5305
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9800	0.0200	0.1196
E20 Exposed floor (normal)	36.1500	0.3200	11.5680
E16 Corner (normal)	10.3200	0.0900	0.9288
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	2.5800	0.0600	0.1548
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	5.3000	0.1600	0.8480
E1 Steel lintel with perforated steel base plate	10.1000	0.0500	0.5050
E3 Sill	9.2000	0.0500	0.4600
E4 Jamb	24.2000	0.0500	1.2100

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.0925 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.1414 (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	42.8029	42.5955	42.3922	41.4373	41.2586	40.4269	40.4269	40.2729	40.7473	41.2586	41.6200	41.9979	(38)
Heat transfer coeff	106.9443	106.7369	106.5336	105.5787	105.4000	104.5684	104.5684	104.4143	104.8887	105.4000	105.7615	106.1393	(39)

Average = Sum(39)m / 12 = 105.5778

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2153	1.2129	1.2106	1.1998	1.1977	1.1883	1.1883	1.1865	1.1919	1.1977	1.2018	1.2061	(40)
HLP (average)												1.1997	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5973 (42)
Hot water usage for mixer showers												
	67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090 (42a)
Hot water usage for baths												
	29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670 (42b)
Hot water usage for other uses												
	41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294 (42c)
Average daily hot water use (litres/day)												127.0959 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)
Energy content (annual)										Total = Sum(45)m =		2111.0357	
Distribution loss (46)m = 0.15 x (45)m													
	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	267.5284	236.5355	250.9951	219.8145	212.5308	190.8955	187.8787	195.6286	198.1111	221.6608	236.6391	264.4786	(62)
WWHRS	-30.9810	-27.3999	-28.6915	-23.7577	-22.1414	-18.9465	-17.7593	-18.8853	-19.6028	-23.1095	-26.1803	-30.4073	(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													
	236.5474	209.1356	222.3036	196.0568	190.3894	171.9490	170.1193	176.7433	178.5083	198.5512	210.4588	234.0713	(64)
										Total per year (kWh/year) = Sum(64)m =		2394.8342	(64)
12Total per year (kWh/year)												2395	(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													
	111.6513	99.1495	106.1539	95.0542	93.3646	85.4386	85.1677	87.7446	87.8378	96.4003	100.6484	110.6372	(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	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.1473	133.0203	120.1473	124.1522	120.1473	124.1522	120.1473	120.1473	124.1522	120.1473	124.1522	120.1473	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(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)													
	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)													
	150.0689	147.5439	142.6800	132.0197	125.4900	118.6648	114.4728	117.9363	121.9970	129.5703	139.7894	148.7059	(72)
Total internal gains													
	570.5261	583.3163	559.4252	539.6681	512.5950	491.2308	472.6496	473.6709	487.8908	507.5609	538.3235	558.7789	(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	
Northeast	11.2800	11.2829	0.6300	0.7000	0.7700	38.8958	(75)
Southeast	1.9800	36.7938	0.6300	0.7000	0.7700	22.2645	(77)
Southwest	3.6000	36.7938	0.6300	0.7000	0.7700	40.4808	(79)

Solar gains	101.6411	186.0520	288.8814	415.4583	517.8498	537.1988	508.3064	428.3871	332.1584	214.8799	124.0954	85.4612	(83)
Total gains	672.1673	769.3684	848.3066	955.1265	1030.4448	1028.4296	980.9560	902.0581	820.0492	722.4408	662.4189	644.2401	(84)

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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	21.8420	21.8845	21.9262	22.1245	22.1620	22.3383	22.3383	22.3713	22.2701	22.1620	22.0863	22.0077	
alpha	2.4561	2.4590	2.4617	2.4750	2.4775	2.4892	2.4892	2.4914	2.4847	2.4775	2.4724	2.4672	
util living area	0.9414	0.9184	0.8821	0.8068	0.6944	0.5503	0.4283	0.4742	0.6673	0.8414	0.9183	0.9466	(86)
MIT	18.3168	18.6436	19.1438	19.8142	20.3804	20.7574	20.9061	20.8765	20.5858	19.8569	18.9854	18.2612	(87)
Th 2	19.9078	19.9097	19.9115	19.9202	19.9218	19.9294	19.9294	19.9308	19.9265	19.9218	19.9185	19.9151	(88)
util rest of house	0.9331	0.9070	0.8653	0.7786	0.6485	0.4806	0.3371	0.3815	0.6026	0.8118	0.9051	0.9390	(89)
MIT 2	16.7968	17.2076	17.8337	18.6598	19.3260	19.7396	19.8766	19.8568	19.5744	18.7322	17.6502	16.7310	(90)
Living area fraction										fLA = Living area / (4) =		0.5440	(91)
MIT	17.6236	17.9887	18.5464	19.2877	19.8996	20.2933	20.4367	20.4115	20.1246	19.3440	18.3765	17.5634	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6236	17.9887	18.5464	19.2877	19.8996	20.2933	20.4367	20.4115	20.1246	19.3440	18.3765	17.5634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9098	0.8813	0.8393	0.7596	0.6475	0.5055	0.3817	0.4248	0.6155	0.7930	0.8806	0.9167	(94)
Useful gains	611.5611	678.0429	712.0031	725.5152	667.1991	519.8267	374.3997	383.2310	504.7702	572.9137	583.3385	590.5914	(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	1424.8881	1397.0521	1283.3431	1096.7247	864.2376	595.3342	401.1925	418.8598	631.9119	921.6171	1192.6187	1418.3853	(97)
Space heating kWh	605.1152	483.1742	425.0770	267.2709	146.5967	0.0000	0.0000	0.0000	0.0000	259.4353	438.6817	615.8786	(98a)
Space heating requirement - total per year (kWh/year)												3241.2296	
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	605.1152	483.1742	425.0770	267.2709	146.5967	0.0000	0.0000	0.0000	0.0000	259.4353	438.6817	615.8786	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3241.2296	
Space heating per m2										(98c) / (4) =		36.8322	(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	605.1152	483.1742	425.0770	267.2709	146.5967	0.0000	0.0000	0.0000	0.0000	259.4353	438.6817	615.8786	(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)	655.5962	523.4823	460.5384	289.5676	158.8263	0.0000	0.0000	0.0000	0.0000	281.0783	475.2782	667.2574	(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	236.5474	209.1356	222.3036	196.0568	190.3894	171.9490	170.1193	176.7433	178.5083	198.5512	210.4588	234.0713	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0718	85.8743	85.4892	84.7552	83.4807	79.8000	79.8000	79.8000	79.8000	84.6606	85.6675	86.1250	(217)
Fuel for water heating, kWh/month	274.8258	243.5369	260.0371	231.3213	228.0641	215.4749	213.1821	221.4828	223.6946	234.5262	245.6693	271.7809	(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	24.9642	20.0272	18.0323	13.2112	10.2047	8.3374	9.3091	12.1003	15.7171	20.6217	23.2922	25.6581	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.3319	-28.8994	-44.0134	-52.5226	-59.3123	-56.3327	-55.6341	-51.1801	-43.8176	-34.3449	-21.8253	-16.5265	(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	-6.4380	-13.8870	-28.2591	-43.4331	-58.4202	-59.0763	-58.3944	-48.9953	-35.3223	-20.1918	-8.6993	-5.0666	(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	3511.6247 (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	2863.5961 (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)	201.4757 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-869.9241 (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	5792.7724 (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	3511.6247	0.2100	737.4412	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2863.5961	0.2100	601.3552	(264)
Space and water heating			1338.7964	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	201.4757	0.1443	29.0792	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.7408	0.1334	-64.5226	
PV Unit electricity exported	-386.1833	0.1252	-48.3583	
Total			-112.8809	(269)
Total CO2, kg/year			1266.9239	(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	3511.6247	1.1300	3968.1359	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2863.5961	1.1300	3235.8636	(278)
Space and water heating			7203.9995	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	201.4757	1.5338	309.0302	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-483.7408	1.4929	-722.1722	
PV Unit electricity exported	-386.1833	0.4596	-177.4956	
Total			-899.6678	(283)
Total Primary energy kWh/year			6743.4627	(286)
Target Primary Energy Rate (TPER)			76.6300	(287)

Full SAP Calculation Printout

Property Reference	Flat 101 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 101 WCS - Green	Prop Type Ref	Flat 102 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	83 B	DER	3.56	TER	17.06
Environmental	97 A	% DER < TER			79.13
CO_2 Emissions (t/year)	0.2	DFEE	42.99	TFEE	46.93
Compliance Check	See BREL	% DFEE < TFEE			8.38
% DPER < TPER	58.80	DPER	37.73	TPER	91.58

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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		61.0000 (1b)	x	2.7500 (2b)	=	167.7500 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	167.7500 (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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Windows (Uw = 0.95)			19.3800	0.9152	17.7370			(27)
Glazed Doors (Uw = 0.95)			2.0500	0.9152	1.8762			(27)
Solid Door			2.0000	0.8000	1.6000			(26)

Heatloss Floor 1			61.0000	0.1200	7.3200		(28b)
External Wall 1	87.5300	23.4300	64.1000	0.1500	9.6150	14.0000	897.4000 (29a)
Total net area of external elements Aum(A, m2)			148.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1482		(33)
Party Wall 1			9.7900	0.0000	0.0000	20.0000	195.8000 (32)
Party Ceiling 1			61.0000			30.0000	1830.0000 (32b)
Internal Wall 1			92.2900			9.0000	830.6100 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3753.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 61.5379 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	13.7500	0.0900	1.2375
E17 Corner (inverted – internal area greater than external area)	5.5000	-0.0900	-0.4950
E20 Exposed floor (normal)	31.8300	0.1250	3.9787
E1 Steel lintel with perforated steel base plate	10.2600	0.0500	0.5130
E3 Sill	9.3100	0.0500	0.4655
E4 Jamb	31.8000	0.0500	1.5900
E7 Party floor between dwellings (in blocks of flats)	31.8300	0.0700	2.2281
E18 Party wall between dwellings	2.7500	0.0600	0.1650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.4430	2.9858
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5600	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	3.5600	0.1600	0.5696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2383 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 51.3865 (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	12.4675	12.3067	12.1458	11.3414	11.1805	10.3761	10.3761	10.2152	10.6978	11.1805	11.5023	11.8240	(38)
Heat transfer coeff	63.8540	63.6931	63.5322	62.7278	62.5670	61.7625	61.7625	61.6017	62.0843	62.5670	62.8887	63.2105	(39)

Average = Sum(39)m / 12 = 62.6876

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0468	1.0441	1.0415	1.0283	1.0257	1.0125	1.0125	1.0099	1.0178	1.0257	1.0310	1.0362	(40)
HLP (average)												1.0277	
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 2.0098 (42)
Hot water usage for mixer showers

57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)

Hot water usage for baths

26.3466	25.9553	25.4043	24.3884	23.6276	22.7841	22.3284	22.8756	23.4714	24.3740	25.4109	26.2576	(42b)

Hot water usage for other uses

37.0652	35.7174	34.3696	33.0218	31.6739	30.3261	30.3261	31.6739	33.0218	34.3696	35.7174	37.0652	(42c)

Average daily hot water use (litres/day) 111.5204 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.3286	118.7191	115.5519	110.7615	106.8621	102.6736	101.0828	104.2365	107.5598	111.9546	116.8181	121.0176	(44)
Energy conte	192.1548	169.0544	177.5990	151.6269	143.8569	126.2492	122.2509	129.0665	132.6320	151.9213	166.4288	189.4843	(45)

Energy content (annual) Total = Sum(45)m = 1852.3250

Distribution loss (46)m = 0.15 x (45)m	28.8232	25.3582	26.6399	22.7440	21.5785	18.9374	18.3376	19.3600	19.8948	22.7882	24.9643	28.4226	(46)

Water storage loss:
Store volume 172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)
Temperature factor from Table 2b 0.7800 (49)
Enter (49) or (54) in (55) 1.2714 (55)
Total storage loss

39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)

If cylinder contains dedicated solar storage

39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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

254.8306	225.6648	240.2748	212.2809	206.5327	186.9032	184.9267	191.7423	193.2860	214.5971	227.0828	252.1601	(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

254.8306	225.6648	240.2748	212.2809	206.5327	186.9032	184.9267	191.7423	193.2860	214.5971	227.0828	252.1601	(64)

Total per year (kWh/year) = Sum(64)m = 2590.2820 (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

114.0321	101.4989	109.1923	98.9391	97.9731	90.5010	90.7891	93.0553	92.6234	100.6545	103.8608	113.1442	(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	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.5003	97.9825	88.5003	91.4503	88.5003	91.4503	88.5003	88.5003	91.4503	88.5003	91.4503	88.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(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)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	153.2690	151.0400	146.7639	137.4155	131.6842	125.6959	122.0283	125.0743	128.6435	135.2883	144.2511	152.0755	(72)
Total internal gains													
	470.3774	479.4514	461.1049	444.9387	423.9274	409.3006	394.9411	396.1664	407.2739	420.7363	444.9792	461.4421	(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	
Southeast	7.4800	36.7938	0.4700	0.7000	0.7700	62.7488	(77)
Southwest	5.1800	36.7938	0.4700	0.7000	0.7700	43.4544	(79)
Northwest	6.7200	11.2829	0.4700	0.7000	0.7700	17.2870	(81)
Southeast	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(77)

Solar gains	140.6875	245.3849	350.9983	460.4685	539.0973	545.4627	521.6129	461.3831	388.6618	275.3150	169.5569	119.7226	(83)
Total gains	611.0650	724.8364	812.1032	905.4072	963.0247	954.7633	916.5540	857.5495	795.9357	696.0513	614.5361	581.1647	(84)

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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	16.3298	16.3711	16.4125	16.6230	16.6657	16.8828	16.8828	16.9269	16.7953	16.6657	16.5805	16.4961	
alpha	2.0887	2.0914	2.0942	2.1082	2.1110	2.1255	2.1255	2.1285	2.1197	2.1110	2.1054	2.0997	
util living area													
	0.8374	0.7843	0.7184	0.6168	0.4999	0.3743	0.2804	0.3088	0.4600	0.6554	0.7874	0.8490	(86)
MIT	18.4700	18.9130	19.4552	20.0773	20.5372	20.8240	20.9316	20.9139	20.7123	20.1040	19.2064	18.3937	(87)
Th 2	20.0445	20.0467	20.0489	20.0598	20.0620	20.0729	20.0729	20.0751	20.0685	20.0620	20.0576	20.0532	(88)
util rest of house													
	0.8234	0.7670	0.6963	0.5879	0.4628	0.3279	0.2258	0.2524	0.4114	0.6223	0.7675	0.8359	(89)
MIT 2	17.1222	17.6644	18.3256	19.0745	19.6059	19.9248	20.0280	20.0161	19.8136	19.1271	18.0435	17.0321	(90)
Living area fraction										fLA = Living area / (4) =		0.3654	(91)
MIT	17.6147	18.1206	18.7383	19.4409	19.9462	20.2534	20.3582	20.3442	20.1420	19.4841	18.4684	17.5296	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6147	18.1206	18.7383	19.4409	19.9462	20.2534	20.3582	20.3442	20.1420	19.4841	18.4684	17.5296	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7793	0.7257	0.6620	0.5675	0.4580	0.3371	0.2429	0.2692	0.4154	0.5998	0.7277	0.7920	(94)
Useful gains	476.2215	525.9840	537.5933	513.7775	441.0460	321.8847	222.6292	230.8462	330.5974	417.4818	447.1683	460.2752	(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													
	850.1987	842.0637	777.5288	661.2089	515.9376	349.1684	232.1152	242.9682	375.1138	555.8480	714.9451	842.5721	(97)
Space heating kWh													
	278.2390	212.4056	178.5120	106.1506	55.7194	0.0000	0.0000	0.0000	0.0000	102.9445	192.7993	284.4289	(98a)
Space heating requirement - total per year (kWh/year)												1411.1993	
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													
	278.2390	212.4056	178.5120	106.1506	55.7194	0.0000	0.0000	0.0000	0.0000	102.9445	192.7993	284.4289	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1411.1993	
Space heating per m2											(98c) / (4) =	23.1344	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
278.2390 212.4056 178.5120 106.1506 55.7194 0.0000 0.0000 0.0000 0.0000 102.9445 192.7993 284.4289		(98)

Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00
307a 278.2390 212.4056 178.5120 106.1506 55.7194 0.0000 0.0000 0.0000 0.0000 102.9445 192.7993 284.4289
Space heating requirement
278.2390 212.4056 178.5120 106.1506 55.7194 0.0000 0.0000 0.0000 0.0000 102.9445 192.7993 284.4289 (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
254.8306 225.6648 240.2748 212.2809 206.5327 186.9032 184.9267 191.7423 193.2860 214.5971 227.0828 252.1601 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00
310a 254.8306 225.6648 240.2748 212.2809 206.5327 186.9032 184.9267 191.7423 193.2860 214.5971 227.0828 252.1601
Water heating fuel
254.8306 225.6648 240.2748 212.2809 206.5327 186.9032 184.9267 191.7423 193.2860 214.5971 227.0828 252.1601 (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 15.0873 13.6272 15.0873 14.6006 15.0873 14.6006 15.0873 15.0873 14.6006 15.0873 14.6006 15.0873 (331)
Lighting 17.0777 13.7004 12.3357 9.0376 6.9809 5.7035 6.3682 8.2777 10.7519 14.1070 15.9339 17.5523 (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 1411.1993 (307)
Space heating fuel - secondary 0.0000 (309)
Water heating fuel - community heating 2590.2820 (310)
Efficiency of water heater 0.0000 (311)
Electricity used for heat distribution 14.1120 (313)
Space cooling fuel 0.0000 (321)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)
mechanical ventilation fans (SFP = 0.8680) 177.6405 (330a)
Total electricity for the above, kWh/year 177.6405 (331)
Electricity for lighting (calculated in Appendix L) 137.8268 (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 4316.9486 (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			350.0000	(367)
Space and Water heating from Heat pump	1143.2804	0.1549	62.4742	(367)
Electrical energy for heat distribution (space & water)	14.1120	0.0000	5.8327	(372)
Overall CO2 factor for heat network			0.0431	(386)
Total CO2 associated with community systems			172.4819	(373)
Space and water heating			172.4819	(376)
Pumps, fans and electric keep-hot	177.6405	0.1387	24.6409	(378)
Energy for lighting	137.8268	0.1443	19.8927	(379)
Total CO2, kg/year			217.0155	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5600	(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			350.0000	(467a)
Space and Water heating from Heat pump	1143.2804	1.5736	634.4876	(467)
Electrical energy for heat distribution (space & water)	14.1120	0.0000	61.5918	(472)
Overall CO2 factor for heat network			0.4552	(486)
Total CO2 associated with community systems			1821.3562	(473)
Space and water heating			1821.3562	(476)
Pumps, fans and electric keep-hot	177.6405	1.5128	268.7346	(478)
Energy for lighting	137.8268	1.5338	211.4034	(479)
Total Primary energy kWh/year			2301.4941	(483)
Dwelling Primary energy Rate (DPER)			37.7300	(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	61.0000	(1b)	x 2.7500	(2b) =	167.7500	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		167.7500	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3692	(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) =	0.2861	(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	0.3648	0.3577	0.3505	0.3148	0.3076	0.2718	0.2718	0.2647	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5666	0.5640	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			61.0000	0.1300	7.9300			(28b)
External Wall 1	87.5300	15.2500	72.2800	0.1800	13.0104			(29a)
Total net area of external elements Aum(A, m2)			148.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1122			(33)
Party Wall 1			9.7900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							71.5379	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
	E16 Corner (normal)	13.7500	0.0900	1.2375
	E17 Corner (inverted – internal area greater than external area)	5.5000	-0.0900	-0.4950
	E20 Exposed floor (normal)	31.8300	0.3200	10.1856
	E1 Steel lintel with perforated steel base plate	10.2600	0.0500	0.5130
	E3 Sill	9.3100	0.0500	0.4655
	E4 Jamb	31.8000	0.0500	1.5900
	E7 Party floor between dwellings (in blocks of flats)	31.8300	0.0700	2.2281
	E18 Party wall between dwellings	2.7500	0.0600	0.1650
	E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.0200	0.1348
	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5600	0.0000	0.0000
	P7 Party Wall - Exposed floor (normal)	3.5600	0.1600	0.5696

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		16.5941	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	54.7063	(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	31.3630	31.2200	31.0797	30.4211	30.2978	29.7242	29.7242	29.6179	29.9451	30.2978	30.5471	30.8078	(38)
Heat transfer coeff	86.0693	85.9262	85.7860	85.1273	85.0041	84.4304	84.4304	84.3242	84.6514	85.0041	85.2534	85.5140	(39)

Average = Sum(39)m / 12 = 85.1267

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4110	1.4086	1.4063	1.3955	1.3935	1.3841	1.3841	1.3824	1.3877	1.3935	1.3976	1.4019	(40)
HLP (average)												1.3955	
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 2.0098 (42)

Hot water usage for mixer showers

57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 108.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m													
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	235.6854	208.5168	221.5575	194.6832	188.6866	169.9697	167.6188	174.2414	176.1348	196.4876	209.0602	233.0789	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(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													
	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921	(64)
									Total per year (kWh/year) = Sum(64)m =			2129.7068	(64)
12Total per year (kWh/year)												2130	(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													
	101.0635	89.8333	96.3659	86.6980	85.4364	78.4808	78.4313	80.6333	80.5307	88.0302	91.4784	100.1968	(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	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.5730	98.0630	88.5730	91.5254	88.5730	91.5254	88.5730	88.5730	91.5254	88.5730	91.5254	88.5730	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(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)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	135.8380	133.6805	129.5241	120.4139	114.8338	109.0011	105.4185	108.3781	111.8482	118.3202	127.0533	134.6731	(72)
Total internal gains													
	456.0192	465.1724	446.9378	431.0123	410.1497	392.6809	378.4040	379.5429	390.5536	406.8409	430.8566	447.1125	(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	
Southeast	5.9000	36.7938	0.6300	0.7000	0.7700	66.3436	(77)
Southwest	3.2000	36.7938	0.6300	0.7000	0.7700	35.9830	(79)
Northwest	4.1500	11.2829	0.6300	0.7000	0.7700	14.3101	(81)

Solar gains	116.6366	203.4285	290.9652	381.6822	446.8317	452.0968	432.3338	382.4304	322.1768	228.2360	140.5694	99.2565	(83)
Total gains	572.6558	668.6009	737.9031	812.6945	856.9814	844.7778	810.7378	761.9733	712.7305	635.0770	571.4260	546.3690	(84)

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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	14.0836	14.1071	14.1302	14.2395	14.2601	14.3570	14.3570	14.3751	14.3195	14.2601	14.2184	14.1751	
alpha	1.9389	1.9405	1.9420	1.9493	1.9507	1.9571	1.9571	1.9583	1.9546	1.9507	1.9479	1.9450	
util living area	0.8917	0.8571	0.8120	0.7357	0.6341	0.5085	0.3984	0.4320	0.5941	0.7629	0.8585	0.8997	(86)
MIT	17.6367	18.0562	18.6557	19.4218	20.0968	20.5937	20.8220	20.7844	20.4114	19.5399	18.4660	17.5574	(87)
Th 2	19.7549	19.7567	19.7585	19.7668	19.7683	19.7755	19.7755	19.7769	19.7728	19.7683	19.7652	19.7619	(88)
util rest of house	0.8787	0.8404	0.7895	0.7027	0.5855	0.4371	0.3043	0.3377	0.5262	0.7261	0.8390	0.8875	(89)
MIT 2	15.9599	16.4737	17.2071	18.1313	18.9169	19.4611	19.6762	19.6493	19.2852	18.2967	16.9940	15.8645	(90)
Living area fraction									fLA = Living area / (4) =			0.3654	(91)
MIT	16.5726	17.0520	17.7364	18.6029	19.3481	19.8750	20.0949	20.0641	19.6967	18.7510	17.5319	16.4831	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.5726	17.0520	17.7364	18.6029	19.3481	19.8750	20.0949	20.0641	19.6967	18.7510	17.5319	16.4831	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8326	0.7927	0.7436	0.6663	0.5670	0.4434	0.3302	0.3613	0.5216	0.6895	0.7927	0.8424	(94)
Useful gains	476.7997	529.9773	548.7382	541.4827	485.8800	374.5488	267.7363	275.2809	371.7456	437.8543	452.9780	460.2782	(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	1056.2927	1044.1715	963.9271	825.9794	650.1169	445.3697	295.0746	308.9730	473.7721	692.8674	889.3521	1050.3790	(97)
Space heating kWh	431.1428	345.5385	308.9006	204.8376	122.1922	0.0000	0.0000	0.0000	0.0000	189.7297	314.1894	439.0350	(98a)
Space heating requirement - total per year (kWh/year)												2355.5658	
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	431.1428	345.5385	308.9006	204.8376	122.1922	0.0000	0.0000	0.0000	0.0000	189.7297	314.1894	439.0350	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2355.5658	
Space heating per m2										(98c) / (4) =		38.6158	(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	431.1428	345.5385	308.9006	204.8376	122.1922	0.0000	0.0000	0.0000	0.0000	189.7297	314.1894	439.0350	(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)	467.1103	374.3646	334.6702	221.9259	132.3860	0.0000	0.0000	0.0000	0.0000	205.5577	340.4002	475.6609	(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	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6443	85.4387	85.0638	84.4217	83.3349	79.8000	79.8000	79.8000	79.8000	84.2192	85.2178	85.7020	(217)
Fuel for water heating, kWh/month	244.2758	216.6467	231.6346	206.5573	203.7129	192.7037	191.0292	198.1223	199.7265	209.8544	219.0692	241.6420	(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	18.4037	14.7641	13.2935	9.7394	7.5230	6.1463	6.8627	8.9204	11.5867	15.2024	17.1711	18.9152	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5969	-17.5773	-27.1420	-32.8623	-37.5441	-35.8317	-35.4032	-32.3657	-27.4007	-21.1001	-13.1797	-9.8887	(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	-3.2891	-7.1384	-14.6063	-22.5667	-30.4642	-30.8345	-30.4655	-25.5007	-18.3146	-10.4031	-4.4529	-2.5846	(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	2552.0756 (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	2554.9747 (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)	148.5286 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-502.5130 (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	4839.0659 (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	2552.0756	0.2100	535.9359	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2554.9747	0.2100	536.5447	(264)
Space and water heating			1072.4806	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.5286	0.1443	21.4373	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8925	0.1331	-40.1795	
PV Unit electricity exported	-200.6205	0.1251	-25.0944	
Total			-65.2740	(269)
Total CO2, kg/year			1040.5731	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.0600	(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	2552.0756	1.1300	2883.8454	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2554.9747	1.1300	2887.1214	(278)
Space and water heating			5770.9668	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.5286	1.5338	227.8181	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8925	1.4918	-450.3634	
PV Unit electricity exported	-200.6205	0.4591	-92.1059	
Total			-542.4694	(283)
Total Primary energy kWh/year			5586.4163	(286)
Target Primary Energy Rate (TPER)			91.5800	(287)

Full SAP Calculation Printout

Property Reference	Flat 102 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 102 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	3.62	TER	17.62
Environmental	97 A	% DER < TER			79.46
CO_2 Emissions (t/year)	0.17	DFEE	40.11	TFEE	44.41
Compliance Check	See BREL	% DFEE < TFEE			9.69
% DPER < TPER	59.41	DPER	38.49	TPER	94.82

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	51.6300 (1b)	x	2.5800 (2b)	=	133.2054 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.2054 (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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Glazed Door (Uw = 0.95)			1.9800	0.9152	1.8121			(27)
Window (Uw = 0.95)			11.2800	0.9152	10.3237			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			51.6300	0.1200	6.1956	30.0000	1548.9000	(28b)
External Wall 1	46.8500	15.1500	31.7000	0.1500	4.7550	14.0000	443.8000	(29a)
Total net area of external elements Aum(A, m2)			98.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.5984			(33)
Party Wall 1			31.7900	0.0000	0.0000	20.0000	635.8000	(32)
Party Ceiling 1			51.6300			30.0000	1548.9000	(32b)
Internal Wall 1			48.6600			9.0000	437.9400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4615.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.3926 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	6.4900	0.0500	0.3245
E3 Sill	6.4900	0.0500	0.3245
E4 Jamb	18.2000	0.0500	0.9100
E7 Party floor between dwellings (in blocks of flats)	18.1600	0.0700	1.2712
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
E20 Exposed floor (normal)	18.1600	0.1250	2.2700
E16 Corner (normal)	2.5800	0.0900	0.2322
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	10.3200	0.0600	0.6192
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4328 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	35.0312 (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	9.9001	9.7724	9.6446	9.0059	8.8781	8.2393	8.2393	8.1116	8.4948	8.8781	9.1336	9.3891	(38)
Heat transfer coeff	44.9313	44.8036	44.6758	44.0371	43.9093	43.2705	43.2705	43.1428	43.5260	43.9093	44.1648	44.4203	(39)

Average = Sum(39)m / 12 = 44.0051

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8703	0.8678	0.8653	0.8529	0.8505	0.8381	0.8381	0.8356	0.8430	0.8505	0.8554	0.8604	(40)
HLP (average)												0.8523	
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												1.7382 (42)
Hot water usage for mixer showers	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.8640	106.5401	103.7098	99.4050	95.9095	92.1515	90.7066	93.5247	96.4970	100.4424	104.8135	108.5816	(44)
Energy conte	172.4140	151.7117	159.3981	136.0804	129.1126	113.3110	109.7018	115.8032	118.9904	136.2993	149.3261	170.0125	(45)
Energy content (annual)										Total = Sum(45)m =		1662.1611	
Distribution loss (46)m = 0.15 x (45)m	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(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	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
										Total per year (kWh/year) = Sum(64)m =		2400.1181	(64)
12Total per year (kWh/year)												2400	(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	107.4683	95.7325	103.1405	93.7699	93.0706	86.1991	86.6165	88.6452	88.0875	95.4602	98.1741	106.6698	(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	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.3972	84.5826	76.3972	78.9438	76.3972	78.9438	76.3972	76.3972	78.9438	76.3972	78.9438	76.3972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(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)													
	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)													
	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734	(72)
Total internal gains													
	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259	(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	
Northwest	1.9800	11.2829	0.4700	0.7000	0.7700	5.0935	(81)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175	(75)

Solar gains	34.1110	69.4340	125.0980	205.4469	276.1609	294.4167	275.4208	219.5687	152.4339	84.8539	42.9205	27.8568	(83)
Total gains	455.4932	498.5858	538.2743	604.3441	656.7266	662.1514	630.6248	575.9277	518.4973	462.7655	442.0688	441.4827	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.5333	28.6147	28.6965	29.1127	29.1974	29.6284	29.6284	29.7162	29.4545	29.1974	29.0285	28.8615	
alpha	2.9022	2.9076	2.9131	2.9408	2.9465	2.9752	2.9752	2.9811	2.9636	2.9465	2.9352	2.9241	
util living area													
	0.8924	0.8619	0.8088	0.6975	0.5533	0.3995	0.2959	0.3350	0.5246	0.7416	0.8528	0.8991	(86)
MIT	19.3816	19.6262	19.9982	20.4725	20.7866	20.9407	20.9819	20.9737	20.8653	20.4617	19.8783	19.3494	(87)
Th 2	20.1929	20.1950	20.1971	20.2077	20.2098	20.2204	20.2204	20.2226	20.2162	20.2098	20.2056	20.2013	(88)
util rest of house													
	0.8812	0.8481	0.7901	0.6702	0.5168	0.3553	0.2454	0.2814	0.4761	0.7112	0.8362	0.8887	(89)
MIT 2	18.3046	18.6087	19.0676	19.6425	20.0011	20.1717	20.2090	20.2051	20.0981	19.6445	18.9347	18.2704	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	18.9861	19.2525	19.6564	20.1677	20.4981	20.6583	20.6980	20.6915	20.5836	20.1616	19.5318	18.9532	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9861	19.2525	19.6564	20.1677	20.4981	20.6583	20.6980	20.6915	20.5836	20.1616	19.5318	18.9532	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8618	0.8298	0.7762	0.6687	0.5304	0.3803	0.2765	0.3140	0.4994	0.7092	0.8203	0.8695	(94)
Useful gains	392.5650	413.7453	417.8179	404.1548	348.3276	251.8320	174.3811	180.8339	258.9148	328.1998	362.6076	383.8680	(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													
	659.8658	643.0447	587.7744	496.1957	386.3194	262.1462	177.3244	185.1452	282.2035	419.8426	549.0466	655.3403	(97)
Space heating kWh													
	198.8718	154.0892	126.4477	66.2695	28.2659	0.0000	0.0000	0.0000	0.0000	68.1822	134.2361	201.9754	(98a)
Space heating requirement - total per year (kWh/year)												978.3378	
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													
	198.8718	154.0892	126.4477	66.2695	28.2659	0.0000	0.0000	0.0000	0.0000	68.1822	134.2361	201.9754	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												978.3378	
Space heating per m2											(98c) / (4) =	18.9490	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		

Space heating requirement													
	198.8718	154.0892	126.4477	66.2695	28.2659	0.0000	0.0000	0.0000	0.0000	68.1822	134.2361	201.9754	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	198.8718	154.0892	126.4477	66.2695	28.2659	0.0000	0.0000	0.0000	0.0000	68.1822	134.2361	201.9754	

Space heating requirement

	198.8718	154.0892	126.4477	66.2695	28.2659	0.0000	0.0000	0.0000	0.0000	68.1822	134.2361	201.9754 (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

	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (64)

Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00

310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883

Water heating fuel

	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (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	13.6919	12.3668	13.6919	13.2502	13.6919	13.2502	13.6919	13.6919	13.2502	13.6919	13.2502	13.6919 (331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006 (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 978.3378 (307)

Space heating fuel - secondary 0.0000 (309)

Water heating fuel - community heating 2400.1181 (310)

Efficiency of water heater 0.0000 (311)

Electricity used for heat distribution 9.7834 (313)

Space cooling fuel 0.0000 (321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)

mechanical ventilation fans (SFP = 0.9920) 161.2105 (330a)

Total electricity for the above, kWh/year 161.2105 (331)

Electricity for lighting (calculated in Appendix L) 135.8500 (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 3675.5164 (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			350.0000	(367)
Space and Water heating from Heat pump	965.2731	0.1555	43.4540	(367)
Electrical energy for heat distribution (space & water)	9.7834	0.0000	4.8978	(372)
Overall CO2 factor for heat network			0.0429	(386)
Total CO2 associated with community systems			144.8344	(373)
Space and water heating			144.8344	(376)
Pumps, fans and electric keep-hot	161.2105	0.1387	22.3619	(378)
Energy for lighting	135.8500	0.1443	19.6074	(379)
Total CO2, kg/year			186.8037	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6200	(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			350.0000	(467a)
Space and Water heating from Heat pump	965.2731	1.5755	440.4014	(467)
Electrical energy for heat distribution (space & water)	9.7834	0.0000	51.9015	(472)
Overall CO2 factor for heat network			0.4543	(486)
Total CO2 associated with community systems			1534.8020	(473)
Space and water heating			1534.8020	(476)
Pumps, fans and electric keep-hot	161.2105	1.5128	243.8792	(478)
Energy for lighting	135.8500	1.5338	208.3713	(479)
Total Primary energy kWh/year			1987.0525	(483)
Dwelling Primary energy Rate (DPER)			38.4900	(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		51.6300 (1b)	x	2.5800 (2b)	=	133.2054 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.2054 (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		2 * 10 =	20.0000	(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) =		20.0000 / (5) =	0.1501	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.4001	(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) =	0.3101	(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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644	(22b)
Effective ac	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.0300	1.1450	12.6298			(27)
Heatloss Floor 1			51.6300	0.1300	6.7119			(28b)
External Wall 1	46.8500	12.9200	33.9300	0.1800	6.1074			(29a)
Total net area of external elements Aum(A, m2)			98.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.3391			(33)
Party Wall 1			31.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 99.3926 (35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E1	Steel lintel with perforated steel base plate	6.4900	0.0500	0.3245
E3	Sill	6.4900	0.0500	0.3245
E4	Jamb	18.2000	0.0500	0.9100
E7	Party floor between dwellings (in blocks of flats)	18.1600	0.0700	1.2712
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
E20	Exposed floor (normal)	18.1600	0.3200	5.8112
E16	Corner (normal)	2.5800	0.0900	0.2322
E17	Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18	Party wall between dwellings	10.3200	0.0600	0.6192
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7	Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3556 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6947 (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	25.4150	25.2815	25.1508	24.5365	24.4215	23.8865	23.8865	23.7874	24.0926	24.4215	24.6540	24.8971	(38)
Heat transfer coeff	64.1096	63.9762	63.8454	63.2311	63.1162	62.5812	62.5812	62.4821	62.7873	63.1162	63.3487	63.5918	(39)

Average = Sum(39)m / 12 = 63.2306

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2417	1.2391	1.2366	1.2247	1.2225	1.2121	1.2121	1.2102	1.2161	1.2225	1.2270	1.2317	(40)
HLP (average)												1.2247	
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												1.7382 (42)
Hot water usage for mixer showers												
	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths												
	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses												
	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	108.8640	106.5401	103.7098	99.4050	95.9095	92.1515	90.7066	93.5247	96.4970	100.4424	104.8135	108.5816	(44)
Energy conte	172.4140	151.7117	159.3981	136.0804	129.1126	113.3110	109.7018	115.8032	118.9904	136.2993	149.3261	170.0125	(45)
Energy content (annual)										Total = Sum(45)m =		1662.1611	
Distribution loss (46)m = 0.15 x (45)m													
	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645	(62)
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434	(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													
	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211	(64)
										Total per year (kWh/year) = Sum(64)m =		2007.1523	(64)
12Total per year (kWh/year)												2007	(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													
	96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708	(65)

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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	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.5233	84.7223	76.5233	79.0741	76.5233	79.0741	76.5233	76.5233	79.0741	76.5233	79.0741	76.5233	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(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)													
	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)													
	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865	(72)
Total internal gains													
	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651	(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	
Northeast	9.3800	11.2829	0.6300	0.7000	0.7700	32.3442	(75)
Northwest	1.6500	11.2829	0.6300	0.7000	0.7700	5.6896	(81)

Solar gains	38.0338	77.4189	139.4842	229.0732	307.9193	328.2745	307.0941	244.8190	169.9637	94.6120	47.8564	31.0603	(83)
Total gains	447.3552	494.5234	540.5997	615.9138	676.4242	680.9526	647.2374	586.1173	520.9705	460.4629	434.9481	432.6254	(84)

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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	22.2347	22.2810	22.3267	22.5436	22.5846	22.7777	22.7777	22.8138	22.7029	22.5846	22.5017	22.4157	
alpha	2.4823	2.4854	2.4884	2.5029	2.5056	2.5185	2.5185	2.5209	2.5135	2.5056	2.5001	2.4944	
util living area													
	0.9299	0.9090	0.8712	0.7871	0.6625	0.5129	0.3956	0.4452	0.6469	0.8274	0.9052	0.9348	(86)
MIT	18.4852	18.7680	19.2498	19.9170	20.4631	20.8011	20.9250	20.8973	20.6271	19.9351	19.1204	18.4408	(87)
Th 2	19.8868	19.8888	19.8908	19.9003	19.9021	19.9103	19.9103	19.9119	19.9071	19.9021	19.8985	19.8947	(88)
util rest of house													
	0.9200	0.8963	0.8527	0.7565	0.6143	0.4434	0.3075	0.3541	0.5800	0.7953	0.8898	0.9256	(89)
MIT 2	16.9897	17.3445	17.9454	18.7619	19.3952	19.7591	19.8698	19.8525	19.5966	18.8061	17.7992	16.9387	(90)
Living area fraction										fLA = Living area / (4) =		0.6328	(91)
MIT	17.9360	18.2453	18.7708	19.4928	20.0709	20.4185	20.5375	20.5136	20.2486	19.5205	18.6353	17.8892	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9360	18.2453	18.7708	19.4928	20.0709	20.4185	20.5375	20.5136	20.2486	19.5205	18.6353	17.8892	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8975	0.8727	0.8304	0.7438	0.6222	0.4769	0.3593	0.4059	0.6023	0.7824	0.8679	0.9037	(94)
Useful gains	401.5011	431.5846	448.9027	458.1242	420.8609	324.7598	232.5419	237.9149	313.7689	360.2810	377.4801	390.9664	(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													
	874.1983	853.7799	783.4344	669.7943	528.3395	364.1260	246.4112	257.0277	386.0566	563.0258	730.7436	870.5211	(97)
Space heating kWh													
	351.6868	283.7153	248.8916	152.4025	79.9640	0.0000	0.0000	0.0000	0.0000	150.8421	254.3497	356.7887	(98a)
Space heating requirement - total per year (kWh/year)												1878.6407	
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													
	351.6868	283.7153	248.8916	152.4025	79.9640	0.0000	0.0000	0.0000	0.0000	150.8421	254.3497	356.7887	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1878.6407	
Space heating per m2											(98c) / (4) =	36.3866	(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													
	351.6868	283.7153	248.8916	152.4025	79.9640	0.0000	0.0000	0.0000	0.0000	150.8421	254.3497	356.7887	(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)													
	381.0258	307.3838	269.6550	165.1165	86.6349	0.0000	0.0000	0.0000	0.0000	163.4259	275.5685	386.5533	(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													
	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.3488	85.1494	84.7215	83.8908	82.5866	79.8000	79.8000	79.8000	79.8000	83.8369	84.8886	85.4005	(217)
Fuel for water heating, kWh/month													
	230.3147	204.3347	218.7848	195.9201	194.0146	182.1778	180.7890	187.3239	188.6473	198.7840	206.9736	227.8922	(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	15.9000	12.7556	11.4850	8.4144	6.4995	5.3102	5.9291	7.7069	10.0104	13.1342	14.8351	16.3419	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.8559	-14.9609	-23.1382	-28.0640	-32.1121	-30.6728	-30.3130	-27.6918	-23.4092	-17.9859	-11.2109	-8.4022	(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	-2.7435	-5.9583	-12.1973	-18.8507	-25.4497	-25.7531	-25.4378	-21.2860	-15.2839	-8.6782	-3.7132	-2.1551	(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	2035.3637 (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	2415.9569 (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)	128.3224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-425.3237 (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	4240.3194 (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	2035.3637	0.2100	427.4264	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2415.9569	0.2100	507.3510	(264)
Space and water heating			934.7773	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	128.3224	0.1443	18.5209	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-257.8168	0.1331	-34.3037	
PV Unit electricity exported	-167.5069	0.1251	-20.9521	
Total			-55.2558	(269)
Total CO2, kg/year			909.9717	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.6200	(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	2035.3637	1.1300	2299.9610	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2415.9569	1.1300	2730.0313	(278)
Space and water heating			5029.9924	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	128.3224	1.5338	196.8252	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-257.8168	1.4917	-384.5749	
PV Unit electricity exported	-167.5069	0.4591	-76.9022	
Total			-461.4771	(283)
Total Primary energy kWh/year			4895.4412	(286)
Target Primary Energy Rate (TPER)			94.8200	(287)

Full SAP Calculation Printout

Property Reference	Flat 102 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 102 WCS - Green	Prop Type Ref	Flat 102 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	82 B	DER	3.72	TER	18.04
Environmental	97 A	% DER < TER			79.38
CO_2 Emissions (t/year)	0.18	DFEE	42.84	TFEE	47.18
Compliance Check	See BREL	% DFEE < TFEE			9.21
% DPER < TPER	59.17	DPER	39.47	TPER	96.67

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 2.7500	(2b) =	143.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		143.0000	(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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Windows (Uw = 0.95)			12.4200	0.9152	11.3671			(27)
Glazed Doors (Uw = 0.95)			4.1000	0.9152	3.7524			(27)
Solid Door			2.0000	0.8000	1.6000			(26)

Heatloss Floor 1			52.0000	0.1200	6.2400			(28b)
External Wall 1	72.8800	18.5200	54.3600	0.1500	8.1540	14.0000	761.0400	(29a)
Total net area of external elements Aum(A, m2)			124.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1135			(33)
Party Wall 1			20.0800	0.0000	0.0000	20.0000	401.6000	(32)
Party Ceiling 1			52.0000			30.0000	1560.0000	(32b)
Internal Wall 1			49.2300			9.0000	443.0700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3165.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		60.8790 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	8.1300	0.0500	0.4065
E3 Sill	7.1800	0.0500	0.3590
E4 Jamb	27.2000	0.0500	1.3600
E18 Party wall between dwellings	11.0000	0.0600	0.6600
E16 Corner (normal)	2.7500	0.0900	0.2475
E17 Corner (inverted – internal area greater than external area)	5.5000	-0.0900	-0.4950
E20 Exposed floor (normal)	26.5000	0.1250	3.3125
E7 Party floor between dwellings (in blocks of flats)	26.5000	0.0700	1.8550
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.4430	2.9858
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	7.3000	0.1600	1.1680

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.8593 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	42.9728 (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	10.6281	10.4909	10.3538	9.6681	9.5309	8.8452	8.8452	8.7080	9.1195	9.5309	9.8052	10.0795	(38)
Heat transfer coeff	53.6009	53.4637	53.3266	52.6408	52.5037	51.8180	51.8180	51.6808	52.0922	52.5037	52.7780	53.0523	(39)

Average = Sum(39)m / 12 = 52.6065

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0308	1.0281	1.0255	1.0123	1.0097	0.9965	0.9965	0.9939	1.0018	1.0097	1.0150	1.0202	(40)
HLP (average)												1.0117	
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												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
									Total per year (kWh/year) = Sum(64)m =			2405.8210	(64)
12Total per year (kWh/year)												2406	(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	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains													
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(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	
Southeast	12.4200	36.7938	0.4700	0.7000	0.7700	104.1899	(77)
Southeast	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(77)
Southwest	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(79)

Solar gains	138.5844	236.0604	322.9882	400.1980	448.2551	445.0136	429.0406	393.1878	349.7279	260.8971	165.9921	118.5993	(83)
Total gains	561.8387	667.1394	738.0015	800.8662	830.4905	814.3523	785.7788	751.0805	717.3771	640.4523	566.8952	534.0513	(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	16.4058	16.4479	16.4902	16.7050	16.7486	16.9703	16.9703	17.0153	16.8809	16.7486	16.6616	16.5754	
alpha	2.0937	2.0965	2.0993	2.1137	2.1166	2.1314	2.1314	2.1344	2.1254	2.1166	2.1108	2.1050	
util living area													
	0.8160	0.7584	0.6930	0.5986	0.4906	0.3694	0.2751	0.2974	0.4360	0.6236	0.7609	0.8287	(86)
MIT	18.6328	19.0741	19.5771	20.1381	20.5574	20.8301	20.9348	20.9209	20.7434	20.1969	19.3488	18.5551	(87)
Th 2	20.0578	20.0599	20.0621	20.0731	20.0753	20.0863	20.0863	20.0885	20.0819	20.0753	20.0709	20.0665	(88)
util rest of house													
	0.8010	0.7402	0.6705	0.5699	0.4543	0.3241	0.2221	0.2435	0.3893	0.5903	0.7399	0.8146	(89)
MIT 2	17.3282	17.8661	18.4776	19.1529	19.6382	19.9426	20.0431	20.0339	19.8547	19.2400	18.2214	17.2371	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	18.1747	18.6499	19.1910	19.7921	20.2346	20.5184	20.6217	20.6094	20.4313	19.8609	18.9529	18.0923	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1747	18.6499	19.1910	19.7921	20.2346	20.5184	20.6217	20.6094	20.4313	19.8609	18.9529	18.0923	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7656	0.7093	0.6476	0.5608	0.4607	0.3459	0.2535	0.2747	0.4075	0.5821	0.7113	0.7789	(94)
Useful gains	430.1558	473.1829	477.9226	449.0921	382.6329	281.6555	199.2044	206.3397	292.3449	372.8186	403.2254	415.9652	(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													
	743.6934	735.1203	676.7691	573.3693	448.1001	306.6819	208.3956	217.5467	329.8134	486.2313	625.5730	737.0168	(97)
Space heating kWh													
	233.2720	176.0219	147.9418	89.4796	48.7076	0.0000	0.0000	0.0000	0.0000	84.3791	160.0903	238.8624	(98a)
Space heating requirement - total per year (kWh/year)												1178.7547	
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													
	233.2720	176.0219	147.9418	89.4796	48.7076	0.0000	0.0000	0.0000	0.0000	84.3791	160.0903	238.8624	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1178.7547	
Space heating per m2											(98c) / (4) =	22.6684	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	233.2720	176.0219	147.9418	89.4796	48.7076	0.0000	0.0000	0.0000	0.0000	84.3791	160.0903	238.8624	(98)

Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00

307a	233.2720	176.0219	147.9418	89.4796	48.7076	0.0000	0.0000	0.0000	0.0000	84.3791	160.0903	238.8624
Space heating requirement												
	233.2720	176.0219	147.9418	89.4796	48.7076	0.0000	0.0000	0.0000	0.0000	84.3791	160.0903	238.8624 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (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	12.8613	11.6166	12.8613	12.4464	12.8613	12.4464	12.8613	12.8613	12.4464	12.8613	12.4464	12.8613 (331)
Lighting	15.5992	12.5143	11.2677	8.2552	6.3766	5.2097	5.8169	7.5610	9.8210	12.8857	14.5544	16.0328 (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	1178.7547 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	2405.8210 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	11.7875 (313)
Space cooling fuel	0.0000 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	151.4313 (330a)
Total electricity for the above, kWh/year	151.4313 (331)
Electricity for lighting (calculated in Appendix L)	125.8946 (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	3861.9016 (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			350.0000	(367)
Space and Water heating from Heat pump	1024.1645	0.1549	52.1802	(367)
Electrical energy for heat distribution (space & water)	11.7875	0.0000	5.2113	(372)
Overall CO2 factor for heat network			0.0430	(386)
Total CO2 associated with community systems			154.1048	(373)
Space and water heating			154.1048	(376)
Pumps, fans and electric keep-hot	151.4313	0.1387	21.0054	(378)
Energy for lighting	125.8946	0.1443	18.1705	(379)
Total CO2, kg/year			193.2807	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7200	(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			350.0000	(467a)
Space and Water heating from Heat pump	1024.1645	1.5736	529.9633	(467)
Electrical energy for heat distribution (space & water)	11.7875	0.0000	55.1231	(472)
Overall CO2 factor for heat network			0.4547	(486)
Total CO2 associated with community systems			1630.0679	(473)
Space and water heating			1630.0679	(476)
Pumps, fans and electric keep-hot	151.4313	1.5128	229.0852	(478)
Energy for lighting	125.8946	1.5338	193.1013	(479)
Total Primary energy kWh/year			2052.2545	(483)
Dwelling Primary energy Rate (DPER)			39.4700	(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	52.0000 (1b)	x	2.7500 (2b)	=	143.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	143.0000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1399 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3899 (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) =	0.3021 (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	0.3852	0.3777	0.3701	0.3324	0.3248	0.2870	0.2870	0.2795	0.3021	0.3248	0.3399	0.3550	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5527	0.5412	0.5412	0.5391	0.5456	0.5527	0.5578	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			11.0100	1.1450	12.6069			(27)
Heatloss Floor 1			52.0000	0.1300	6.7600			(28b)
External Wall 1	72.8800	13.0100	59.8700	0.1800	10.7766			(29a)
Total net area of external elements Aum(A, m2)			124.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1435			(33)
Party Wall 1			20.0800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 70.8790 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	8.1300	0.0500	0.4065
E3 Sill	7.1800	0.0500	0.3590
E4 Jamb	27.2000	0.0500	1.3600
E18 Party wall between dwellings	11.0000	0.0600	0.6600
E16 Corner (normal)	2.7500	0.0900	0.2475
E17 Corner (inverted – internal area greater than external area)	5.5000	-0.0900	-0.4950
E20 Exposed floor (normal)	26.5000	0.3200	8.4800
E7 Party floor between dwellings (in blocks of flats)	26.5000	0.0700	1.8550
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.7400	0.0200	0.1348
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	7.3000	0.1600	1.1680

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.1758 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.3193 (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	27.0966	26.9606	26.8273	26.2013	26.0842	25.5390	25.5390	25.4380	25.7490	26.0842	26.3211	26.5688	(38)
Heat transfer coeff	73.4158	73.2799	73.1466	72.5206	72.4035	71.8582	71.8582	71.7573	72.0682	72.4035	72.6404	72.8881	(39)

Average = Sum(39)m / 12 = 72.5200

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4118	1.4092	1.4067	1.3946	1.3924	1.3819	1.3819	1.3799	1.3859	1.3924	1.3969	1.4017	(40)
HLP (average)												1.3946	
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												1.7491 (42)
Hot water usage for mixer showers												
	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths												
	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses												
	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m													
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
										Total per year (kWh/year) = Sum(64)m =		2012.0777	(64)
12Total per year (kWh/year)												2012	(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													
	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0499	85.3052	77.0499	79.6182	77.0499	79.6182	77.0499	77.0499	79.6182	77.0499	79.6182	77.0499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains													
	411.2360	419.0786	402.9950	388.6554	370.2170	354.3259	341.7199	342.8743	352.6365	367.5369	388.8904	403.4336	(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	
Southeast	9.6400	36.7938	0.6300	0.7000	0.7700	108.3987	(77)
Southwest	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052	(79)

Solar gains	123.8039	210.8838	288.5404	357.5155	400.4472	397.5513	383.2819	351.2530	312.4282	233.0715	148.2885	105.9503	(83)
Total gains	535.0399	629.9624	691.5353	746.1710	770.6642	751.8773	725.0018	694.1273	665.0647	600.6084	537.1788	509.3839	(84)

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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	13.9453	13.9712	13.9967	14.1175	14.1403	14.2476	14.2476	14.2677	14.2061	14.1403	14.0942	14.0463	
alpha	1.9297	1.9314	1.9331	1.9412	1.9427	1.9498	1.9498	1.9512	1.9471	1.9427	1.9396	1.9364	
util living area													
	0.8752	0.8351	0.7870	0.7119	0.6148	0.4927	0.3827	0.4097	0.5616	0.7316	0.8369	0.8843	(86)
MIT	17.7619	18.2034	18.7888	19.5100	20.1406	20.6130	20.8326	20.8022	20.4656	19.6494	18.5919	17.6788	(87)
Th 2	19.7543	19.7563	19.7582	19.7675	19.7692	19.7772	19.7772	19.7787	19.7741	19.7692	19.7657	19.7620	(88)
util rest of house													
	0.8607	0.8166	0.7628	0.6779	0.5660	0.4223	0.2915	0.3187	0.4942	0.6927	0.8155	0.8708	(89)
MIT 2	16.1147	16.6522	17.3645	18.2314	18.9627	19.4789	19.6842	19.6625	19.3359	18.4191	17.1459	16.0155	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.1834	17.6587	18.2887	19.0610	19.7270	20.2148	20.4294	20.4020	20.0689	19.2174	18.0842	17.0947	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1834	17.6587	18.2887	19.0610	19.7270	20.2148	20.4294	20.4020	20.0689	19.2174	18.0842	17.0947	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8218	0.7781	0.7288	0.6559	0.5642	0.4487	0.3418	0.3669	0.5115	0.6727	0.7794	0.8324	(94)
Useful gains	439.6744	490.1707	503.9617	489.3807	434.7753	337.3906	247.7799	254.6858	340.2130	404.0110	418.6533	423.9975	(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													
	945.8486	934.9567	862.3010	736.8801	581.1812	403.4692	275.1714	287.1747	430.1666	623.9268	797.8941	939.8693	(97)
Space heating kWh													
	376.5936	298.8962	266.6045	178.1996	108.9260	0.0000	0.0000	0.0000	0.0000	163.6174	273.0534	383.8086	(98a)
Space heating requirement - total per year (kWh/year)												2049.6991	
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													
	376.5936	298.8962	266.6045	178.1996	108.9260	0.0000	0.0000	0.0000	0.0000	163.6174	273.0534	383.8086	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2049.6991	
Space heating per m2											(98c) / (4) =	39.4173	(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													
	376.5936	298.8962	266.6045	178.1996	108.9260	0.0000	0.0000	0.0000	0.0000	163.6174	273.0534	383.8086	(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)													
	408.0104	323.8312	288.8456	193.0656	118.0130	0.0000	0.0000	0.0000	0.0000	177.2670	295.8325	415.8273	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4878	85.2565	84.8686	84.2360	83.2080	79.8000	79.8000	79.8000	79.8000	84.0131	85.0392	85.5482	(217)
Fuel for water heating, kWh/month													
	230.5344	204.6020	218.9585	195.5953	193.0261	182.6008	181.2006	187.7579	189.0926	198.8495	207.1263	228.0848	(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	16.0094	12.8434	11.5640	8.4723	6.5443	5.3467	5.9699	7.7599	10.0793	13.2246	14.9372	16.4544	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6274	-17.4949	-26.8234	-32.2449	-36.6429	-34.9106	-34.5015	-31.6398	-26.9259	-20.9111	-13.1732	-9.9292	(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	-3.6002	-7.7879	-15.8830	-24.4562	-32.9263	-33.2857	-32.8789	-27.5547	-19.8385	-11.3152	-4.8641	-2.8303	(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	2220.6924 (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	2417.4287 (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)	129.2053 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.0461 (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	4339.2804 (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	2220.6924	0.2100	466.3454	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2417.4287	0.2100	507.6600	(264)
Space and water heating			974.0054	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.2053	0.1443	18.6483	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8249	0.1332	-39.5454	
PV Unit electricity exported	-217.2211	0.1252	-27.1932	
Total			-66.7387	(269)
Total CO2, kg/year			937.8444	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.0400	(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	2220.6924	1.1300	2509.3824	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2417.4287	1.1300	2731.6945	(278)
Space and water heating			5241.0769	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.2053	1.5338	198.1795	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8249	1.4923	-442.9550	
PV Unit electricity exported	-217.2211	0.4595	-99.8107	
Total			-542.7657	(283)
Total Primary energy kWh/year			5026.5915	(286)
Target Primary Energy Rate (TPER)			96.6700	(287)

Full SAP Calculation Printout

Property Reference	Flat 103 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 103 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	3.59	TER	17.45
Environmental	97 A	% DER < TER			79.43
CO_2 Emissions (t/year)	0.17	DFEE	39.39	TFEE	43.62
Compliance Check	See BREL	% DFEE < TFEE			9.70
% DPER < TPER	59.29	DPER	38.22	TPER	93.90

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	51.6300 (1b)	x	2.5800 (2b)	=	133.2054 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.2054 (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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Glazed Door (Uw = 0.95)			1.9800	0.9152	1.8121			(27)
Window (Uw = 0.95)			11.2800	0.9152	10.3237			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			51.6300	0.1200	6.1956	30.0000	1548.9000	(28b)
External Wall 1	46.8500	15.1500	31.7000	0.1500	4.7550	14.0000	443.8000	(29a)
Total net area of external elements Aum(A, m2)			98.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.5984			(33)
Party Wall 1			31.7900	0.0000	0.0000	20.0000	635.8000	(32)
Party Ceiling 1			51.6300			30.0000	1548.9000	(32b)
Internal Wall 1			48.6600			9.0000	437.9400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4615.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		89.3926 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	6.4900	0.0500	0.3245
E3 Sill	6.4900	0.0500	0.3245
E4 Jamb	18.2000	0.0500	0.9100
E7 Party floor between dwellings (in blocks of flats)	18.1600	0.0700	1.2712
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
E20 Exposed floor (normal)	18.1600	0.1250	2.2700
E16 Corner (normal)	2.5800	0.0900	0.2322
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	10.3200	0.0600	0.6192
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.4328 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	35.0312 (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	9.9001	9.7724	9.6446	9.0059	8.8781	8.2393	8.2393	8.1116	8.4948	8.8781	9.1336	9.3891	(38)
Heat transfer coeff	44.9313	44.8036	44.6758	44.0371	43.9093	43.2705	43.2705	43.1428	43.5260	43.9093	44.1648	44.4203	(39)

Average = Sum(39)m / 12 = 44.0051

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8703	0.8678	0.8653	0.8529	0.8505	0.8381	0.8381	0.8356	0.8430	0.8505	0.8554	0.8604	(40)
HLP (average)												0.8523	
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												1.7382 (42)
Hot water usage for mixer showers	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.8640	106.5401	103.7098	99.4050	95.9095	92.1515	90.7066	93.5247	96.4970	100.4424	104.8135	108.5816	(44)
Energy conte	172.4140	151.7117	159.3981	136.0804	129.1126	113.3110	109.7018	115.8032	118.9904	136.2993	149.3261	170.0125	(45)
Energy content (annual)										Total = Sum(45)m =		1662.1611	
Distribution loss (46)m = 0.15 x (45)m	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(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	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
										Total per year (kWh/year) = Sum(64)m =		2400.1181	(64)
12Total per year (kWh/year)												2400	(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	107.4683	95.7325	103.1405	93.7699	93.0706	86.1991	86.6165	88.6452	88.0875	95.4602	98.1741	106.6698	(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	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.3972	84.5826	76.3972	78.9438	76.3972	78.9438	76.3972	76.3972	78.9438	76.3972	78.9438	76.3972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(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)													
	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)													
	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734	(72)
Total internal gains													
	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259	(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	
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100	(77)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175	(75)

Solar gains	45.6275	87.3590	145.1299	222.7349	288.6497	303.7910	285.7172	233.9078	171.5888	103.4531	56.4065	37.9119	(83)
Total gains	467.0097	516.5108	558.3061	621.6321	669.2154	671.5257	640.9212	590.2669	537.6522	481.3648	455.5548	451.5377	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.5333	28.6147	28.6965	29.1127	29.1974	29.6284	29.6284	29.7162	29.4545	29.1974	29.0285	28.8615	
alpha	2.9022	2.9076	2.9131	2.9408	2.9465	2.9752	2.9752	2.9811	2.9636	2.9465	2.9352	2.9241	
util living area													
	0.8869	0.8525	0.7969	0.6862	0.5455	0.3945	0.2914	0.3274	0.5099	0.7266	0.8445	0.8944	(86)
MIT	19.4179	19.6762	20.0432	20.4963	20.7946	20.9427	20.9826	20.9753	20.8753	20.4928	19.9147	19.3820	(87)
Th 2	20.1929	20.1950	20.1971	20.2077	20.2098	20.2204	20.2204	20.2226	20.2162	20.2098	20.2056	20.2013	(88)
util rest of house													
	0.8753	0.8381	0.7775	0.6586	0.5091	0.3507	0.2416	0.2749	0.4620	0.6956	0.8272	0.8836	(89)
MIT 2	18.3492	18.6694	19.1210	19.6692	20.0093	20.1734	20.2094	20.2062	20.1072	19.6792	18.9784	18.3106	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	19.0254	19.3065	19.7045	20.1926	20.5062	20.6602	20.6987	20.6929	20.5932	20.1941	19.5709	18.9886	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0254	19.3065	19.7045	20.1926	20.5062	20.6602	20.6987	20.6929	20.5932	20.1941	19.5709	18.9886	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8560	0.8203	0.7646	0.6581	0.5231	0.3756	0.2723	0.3069	0.4854	0.6949	0.8118	0.8644	(94)
Useful gains	399.7542	423.6766	426.8684	409.0861	350.0385	252.2476	174.5295	181.1524	261.0012	334.5033	369.8132	390.3066	(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													
	661.6338	645.4606	589.9241	497.2923	386.6729	262.2263	177.3525	185.2056	282.6246	421.2683	550.7748	656.9132	(97)
Space heating kWh													
	194.8384	149.0389	121.3134	63.5085	27.2560	0.0000	0.0000	0.0000	0.0000	64.5532	130.2923	198.3553	(98a)
Space heating requirement - total per year (kWh/year)												949.1559	
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													
	194.8384	149.0389	121.3134	63.5085	27.2560	0.0000	0.0000	0.0000	0.0000	64.5532	130.2923	198.3553	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												949.1559	
Space heating per m2											(98c) / (4) =	18.3838	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		

Space heating requirement													
	194.8384	149.0389	121.3134	63.5085	27.2560	0.0000	0.0000	0.0000	0.0000	64.5532	130.2923	198.3553	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	194.8384	149.0389	121.3134	63.5085	27.2560	0.0000	0.0000	0.0000	0.0000	64.5532	130.2923	198.3553	

Space heating requirement

	194.8384	149.0389	121.3134	63.5085	27.2560	0.0000	0.0000	0.0000	0.0000	64.5532	130.2923	198.3553 (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

	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (64)

Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00

310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883

Water heating fuel

	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (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	13.6919	12.3668	13.6919	13.2502	13.6919	13.2502	13.6919	13.6919	13.2502	13.6919	13.2502	13.6919 (331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006 (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 949.1559 (307)

Space heating fuel - secondary 0.0000 (309)

Water heating fuel - community heating 2400.1181 (310)

Efficiency of water heater 0.0000 (311)

Electricity used for heat distribution 9.4916 (313)

Space cooling fuel 0.0000 (321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)

mechanical ventilation fans (SFP = 0.9920) 161.2105 (330a)

Total electricity for the above, kWh/year 161.2105 (331)

Electricity for lighting (calculated in Appendix L) 135.8500 (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 3646.3345 (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			350.0000	(367)
Space and Water heating from Heat pump	956.9354	0.1555	42.1802	(367)
Electrical energy for heat distribution (space & water)	9.4916	0.0000	4.8532	(372)
Overall CO2 factor for heat network			0.0428	(386)
Total CO2 associated with community systems			143.5160	(373)
Space and water heating			143.5160	(376)
Pumps, fans and electric keep-hot	161.2105	0.1387	22.3619	(378)
Energy for lighting	135.8500	0.1443	19.6074	(379)
Total CO2, kg/year			185.4853	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5900	(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			350.0000	(467a)
Space and Water heating from Heat pump	956.9354	1.5758	427.3464	(467)
Electrical energy for heat distribution (space & water)	9.4916	0.0000	51.4446	(472)
Overall CO2 factor for heat network			0.4542	(486)
Total CO2 associated with community systems			1521.2901	(473)
Space and water heating			1521.2901	(476)
Pumps, fans and electric keep-hot	161.2105	1.5128	243.8792	(478)
Energy for lighting	135.8500	1.5338	208.3713	(479)
Total Primary energy kWh/year			1973.5406	(483)
Dwelling Primary energy Rate (DPER)			38.2200	(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		51.6300 (1b)	x	2.5800 (2b)	=	133.2054 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.2054 (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		2 * 10 =	20.0000	(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) =		20.0000 / (5) =	0.1501	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.4001	(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) =	0.3101	(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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644	(22b)
Effective ac	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.0300	1.1450	12.6298			(27)
Heatloss Floor 1			51.6300	0.1300	6.7119			(28b)
External Wall 1	46.8500	12.9200	33.9300	0.1800	6.1074			(29a)
Total net area of external elements Aum(A, m2)			98.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.3391			(33)
Party Wall 1			31.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 99.3926 (35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E1	Steel lintel with perforated steel base plate	6.4900	0.0500	0.3245
E3	Sill	6.4900	0.0500	0.3245
E4	Jamb	18.2000	0.0500	0.9100
E7	Party floor between dwellings (in blocks of flats)	18.1600	0.0700	1.2712
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
E20	Exposed floor (normal)	18.1600	0.3200	5.8112
E16	Corner (normal)	2.5800	0.0900	0.2322
E17	Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18	Party wall between dwellings	10.3200	0.0600	0.6192
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7	Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3556 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6947 (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	25.4150	25.2815	25.1508	24.5365	24.4215	23.8865	23.8865	23.7874	24.0926	24.4215	24.6540	24.8971	(38)
Heat transfer coeff	64.1096	63.9762	63.8454	63.2311	63.1162	62.5812	62.5812	62.4821	62.7873	63.1162	63.3487	63.5918	(39)

Average = Sum(39)m / 12 = 63.2306

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2417	1.2391	1.2366	1.2247	1.2225	1.2121	1.2121	1.2102	1.2161	1.2225	1.2270	1.2317	(40)
HLP (average)												1.2247	
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												1.7382 (42)
Hot water usage for mixer showers												
	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths												
	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses												
	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	108.8640	106.5401	103.7098	99.4050	95.9095	92.1515	90.7066	93.5247	96.4970	100.4424	104.8135	108.5816	(44)
Energy conte	172.4140	151.7117	159.3981	136.0804	129.1126	113.3110	109.7018	115.8032	118.9904	136.2993	149.3261	170.0125	(45)
Energy content (annual)										Total = Sum(45)m =		1662.1611	
Distribution loss (46)m = 0.15 x (45)m													
	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645	(62)
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434	(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													
	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211	(64)
										Total per year (kWh/year) = Sum(64)m =		2007.1523	(64)
12Total per year (kWh/year)												2007	(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													
	96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708	(65)

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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	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.5233	84.7223	76.5233	79.0741	76.5233	79.0741	76.5233	76.5233	79.0741	76.5233	79.0741	76.5233	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(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)													
	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)													
	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865	(72)
Total internal gains													
	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651	(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	
Northeast	9.3800	11.2829	0.6300	0.7000	0.7700	32.3442	(75)
Southeast	1.6500	36.7938	0.6300	0.7000	0.7700	18.5537	(77)

Solar gains	50.8980	97.4415	161.8602	248.3843	321.8695	338.7458	318.5953	260.8361	191.3602	115.3878	62.9205	42.2920	(83)
Total gains	460.2194	514.5460	562.9758	635.2249	690.3745	691.4239	658.7386	602.1344	542.3670	481.2387	450.0123	443.8572	(84)

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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	22.2347	22.2810	22.3267	22.5436	22.5846	22.7777	22.7777	22.8138	22.7029	22.5846	22.5017	22.4157	
alpha	2.4823	2.4854	2.4884	2.5029	2.5056	2.5185	2.5185	2.5209	2.5135	2.5056	2.5001	2.4944	
util living area													
	0.9260	0.9021	0.8620	0.7774	0.6547	0.5071	0.3896	0.4356	0.6314	0.8151	0.8991	0.9315	(86)
MIT	18.5241	18.8244	19.3049	19.9520	20.4781	20.8063	20.9275	20.9024	20.6482	19.9787	19.1625	18.4756	(87)
Th 2	19.8868	19.8888	19.8908	19.9003	19.9021	19.9103	19.9103	19.9119	19.9071	19.9021	19.8985	19.8947	(88)
util rest of house													
	0.9156	0.8887	0.8426	0.7461	0.6064	0.4380	0.3026	0.3457	0.5643	0.7817	0.8830	0.9218	(89)
MIT 2	17.0381	17.4136	18.0115	18.8017	19.4106	19.7634	19.8713	19.8557	19.6160	18.8556	17.8503	16.9819	(90)
Living area fraction										fLA = Living area / (4) =		0.6328	(91)
MIT	17.9784	18.3063	18.8300	19.5295	20.0861	20.4233	20.5396	20.5180	20.2691	19.5662	18.6806	17.9270	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9784	18.3063	18.8300	19.5295	20.0861	20.4233	20.5396	20.5180	20.2691	19.5662	18.6806	17.9270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8927	0.8649	0.8206	0.7344	0.6150	0.4716	0.3539	0.3971	0.5879	0.7700	0.8609	0.8996	(94)
Useful gains	410.8545	445.0148	461.9914	466.5051	424.5689	326.0476	233.1421	239.1116	318.8511	370.5623	387.4339	399.2889	(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													
	876.9183	857.6849	787.2110	672.1181	529.2982	364.4305	246.5465	257.3014	387.3428	565.9148	733.6167	872.9267	(97)
Space heating kWh													
	346.7515	277.3143	241.9634	148.0414	77.9185	0.0000	0.0000	0.0000	0.0000	145.3423	249.2516	352.3865	(98a)
Space heating requirement - total per year (kWh/year)												1838.9695	
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													
	346.7515	277.3143	241.9634	148.0414	77.9185	0.0000	0.0000	0.0000	0.0000	145.3423	249.2516	352.3865	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1838.9695	
Space heating per m2											(98c) / (4) =	35.6182	(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													
	346.7515	277.3143	241.9634	148.0414	77.9185	0.0000	0.0000	0.0000	0.0000	145.3423	249.2516	352.3865	(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)													
	375.6788	300.4489	262.1488	160.3915	84.4188	0.0000	0.0000	0.0000	0.0000	157.4673	270.0451	381.7839	(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													
	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.3187	85.0998	84.6584	83.8261	82.5370	79.8000	79.8000	79.8000	79.8000	83.7544	84.8437	85.3742	(217)
Fuel for water heating, kWh/month													
	230.3960	204.4539	218.9477	196.0713	194.1312	182.1778	180.7890	187.3239	188.6473	198.9799	207.0830	227.9624	(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	15.9000	12.7556	11.4850	8.4144	6.4995	5.3102	5.9291	7.7069	10.0104	13.1342	14.8351	16.3419	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.8559	-14.9609	-23.1382	-28.0640	-32.1121	-30.6728	-30.3130	-27.6918	-23.4092	-17.9859	-11.2109	-8.4022	(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	-2.7435	-5.9583	-12.1973	-18.8507	-25.4497	-25.7531	-25.4378	-21.2860	-15.2839	-8.6782	-3.7132	-2.1551	(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	1992.3830 (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	2416.9636 (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)	128.3224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-425.3237 (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	4198.3453 (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	1992.3830	0.2100	418.4004	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2416.9636	0.2100	507.5623	(264)
Space and water heating			925.9628	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	128.3224	0.1443	18.5209	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-257.8168	0.1331	-34.3037	
PV Unit electricity exported	-167.5069	0.1251	-20.9521	
Total			-55.2558	(269)
Total CO2, kg/year			901.1571	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.4500	(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	1992.3830	1.1300	2251.3928	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2416.9636	1.1300	2731.1688	(278)
Space and water heating			4982.5616	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	128.3224	1.5338	196.8252	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-257.8168	1.4917	-384.5749	
PV Unit electricity exported	-167.5069	0.4591	-76.9022	
Total			-461.4771	(283)
Total Primary energy kWh/year			4848.0105	(286)
Target Primary Energy Rate (TPER)			93.9000	(287)

Full SAP Calculation Printout

Property Reference	Flat 103 WCS - Green	Issued on Date	06/05/2023
Assessment Reference	Flat 103 WCS - Green	Prop Type Ref	Flat 102 WCS - Green
Property	West Central Street, London, WC1A		

SAP Rating	83 B	DER	3.33	TER	15.71
Environmental	97 A	% DER < TER			78.80
CO_2 Emissions (t/year)	0.22	DFEE	40.70	TFEE	44.50
Compliance Check	See BREL	% DFEE < TFEE			8.54
% DPER < TPER	57.71	DPER	35.59	TPER	84.16

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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		73.0000 (1b)	x	2.7500 (2b)	=	200.7500 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	200.7500	(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) =	84.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Windows (Uw = 0.95)			19.9200	0.9152	18.2312			(27)
Glazed Doors (Uw = 0.95)			4.1000	0.9152	3.7524			(27)
Solid Door			2.0000	0.8000	1.6000			(26)

Heatloss Floor 1			73.0000	0.1200	8.7600			(28b)
External Wall 1	74.8600	26.0200	48.8400	0.1500	7.3260	14.0000	683.7600	(29a)
Total net area of external elements Aum(A, m2)			147.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6696			(33)
Party Wall 1			10.4500	0.0000	0.0000	20.0000	209.0000	(32)
Corridor Wall			37.1300	0.0000	0.0000	20.0000	742.6000	(32)
Party Ceiling 1			73.0000			30.0000	2190.0000	(32b)
Internal Wall 1			96.8000			9.0000	871.2000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4696.5601 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		64.3364 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	11.0000	0.0900	0.9900
E17 Corner (inverted – internal area greater than external area)	2.7500	-0.0900	-0.2475
E20 Exposed floor (normal)	27.2200	0.1250	3.4025
E18 Party wall between dwellings	2.7500	0.0600	0.1650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.8600	0.4430	2.1530
E1 Steel lintel with perforated steel base plate	11.3900	0.0500	0.5695
E3 Sill	10.4400	0.0500	0.5220
E4 Jamb	41.0000	0.0500	2.0500
E7 Party floor between dwellings (in blocks of flats)	27.2200	0.0700	1.9054
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	17.3000	0.1600	2.7680

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.2779 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	53.9475 (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	14.9202	14.7276	14.5351	13.5725	13.3799	12.4173	12.4173	12.2247	12.8023	13.3799	13.7650	14.1501	(38)
Heat transfer coeff	68.8677	68.6751	68.4826	67.5200	67.3274	66.3648	66.3648	66.1722	66.7498	67.3274	67.7125	68.0976	(39)
Average = Sum(39)m / 12 =												67.4718	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9434	0.9408	0.9381	0.9249	0.9223	0.9091	0.9091	0.9065	0.9144	0.9223	0.9276	0.9328	(40)
HLP (average)												0.9243	
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											2.3167	(42)
Hot water usage for mixer showers	63.0631	62.1154	60.7344	58.0921	56.1421	53.9675	52.7315	54.1021	55.6045	57.9393	60.6384	62.8215	(42a)
Hot water usage for baths	27.2424	26.8378	26.2681	25.2176	24.4310	23.5588	23.0876	23.6534	24.2694	25.2027	26.2748	27.1503	(42b)
Hot water usage for other uses	38.3553	36.9606	35.5658	34.1711	32.7764	31.3816	31.3816	32.7764	34.1711	35.5658	36.9606	38.3553	(42c)
Average daily hot water use (litres/day)												118.2686	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6609	125.9138	122.5683	117.4808	113.3495	108.9079	107.2008	110.5318	114.0450	118.7078	123.8738	128.3271	(44)
Energy conte	203.7674	179.2996	188.3830	160.8253	152.5902	133.9150	129.6500	136.8615	140.6288	161.0854	176.4809	200.9293	(45)
Energy content (annual)										Total = Sum(45)m =		1964.4164	
Distribution loss (46)m = 0.15 x (45)m	30.5651	26.8949	28.2574	24.1238	22.8885	20.0873	19.4475	20.5292	21.0943	24.1628	26.4721	30.1394	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	266.4432	235.9100	251.0588	221.4793	215.2660	194.5690	192.3258	199.5373	201.2828	223.7612	237.1349	263.6051	(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	266.4432	235.9100	251.0588	221.4793	215.2660	194.5690	192.3258	199.5373	201.2828	223.7612	237.1349	263.6051	(64)
										Total per year (kWh/year) = Sum(64)m =		2702.3734	(64)
12Total per year (kWh/year)												2702	(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	117.8933	104.9054	112.7780	101.9976	100.8769	93.0499	93.2493	95.6471	95.2823	103.7015	107.2031	116.9496	(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	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	102.9930	114.0280	102.9930	106.4261	102.9930	106.4261	102.9930	102.9930	106.4261	102.9930	106.4261	102.9930	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(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)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	158.4587	156.1093	151.5833	141.6634	135.5872	129.2360	125.3351	128.5579	132.3365	139.3838	148.8932	157.1904	(72)
Total internal gains													
	523.3974	534.2019	513.3013	495.4472	471.5887	455.1844	438.8407	439.9446	452.4959	467.4774	494.7692	513.1195	(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	
Northeast	1.7000	11.2829	0.4700	0.7000	0.7700	4.3732	(75)
Southeast	11.5000	36.7938	0.4700	0.7000	0.7700	96.4722	(77)
Northwest	6.7200	11.2829	0.4700	0.7000	0.7700	17.2870	(81)
Southeast	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(77)
Southwest	2.0500	36.7938	0.4700	0.7000	0.7700	17.1972	(79)

Solar gains	152.5268	267.0043	384.4372	508.3682	598.6518	607.1831	580.0374	510.7156	427.0459	300.2492	184.0022	129.6834	(83)
Total gains	675.9243	801.2062	897.7386	1003.8153	1070.2405	1062.3675	1018.8781	950.6603	879.5418	767.7267	678.7714	642.8028	(84)

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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	18.9436	18.9967	19.0501	19.3217	19.3769	19.6580	19.6580	19.7152	19.5446	19.3769	19.2668	19.1578	
alpha	2.2629	2.2664	2.2700	2.2881	2.2918	2.3105	2.3105	2.3143	2.3030	2.2918	2.2845	2.2772	
util living area													
	0.8496	0.7961	0.7284	0.6217	0.4993	0.3695	0.2750	0.3042	0.4599	0.6636	0.7992	0.8611	(86)
MIT	18.7468	19.1670	19.6697	20.2381	20.6372	20.8719	20.9531	20.9395	20.7775	20.2459	19.4278	18.6774	(87)
Th 2	20.1308	20.1330	20.1352	20.1464	20.1486	20.1598	20.1598	20.1620	20.1553	20.1486	20.1441	20.1397	(88)
util rest of house													
	0.8369	0.7801	0.7077	0.5945	0.4647	0.3270	0.2257	0.2531	0.4147	0.6325	0.7809	0.8492	(89)
MIT 2	17.4982	18.0166	18.6336	19.3227	19.7858	20.0496	20.1279	20.1192	19.9543	19.3506	18.3572	17.4173	(90)
Living area fraction										fLA = Living area / (4) =		0.5347	(91)
MIT	18.1658	18.6317	19.1875	19.8122	20.2410	20.4893	20.5691	20.5578	20.3944	19.8293	18.9296	18.0910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1658	18.6317	19.1875	19.8122	20.2410	20.4893	20.5691	20.5578	20.3944	19.8293	18.9296	18.0910	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8023	0.7482	0.6828	0.5832	0.4685	0.3439	0.2500	0.2776	0.4278	0.6199	0.7508	0.8149	(94)
Useful gains	542.2952	599.4509	612.9500	585.4630	501.4394	365.3984	254.7316	263.8564	376.2951	475.9196	509.6211	523.7882	(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													
	954.9051	943.0251	868.8753	736.7889	575.0421	390.8388	263.4063	275.1310	420.1495	621.3824	801.0133	945.9461	(97)
Space heating kWh													
	306.9818	230.8819	190.4084	108.9546	54.7604	0.0000	0.0000	0.0000	0.0000	108.2243	209.8024	314.0854	(98a)
Space heating requirement - total per year (kWh/year)												1524.0992	
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													
	306.9818	230.8819	190.4084	108.9546	54.7604	0.0000	0.0000	0.0000	0.0000	108.2243	209.8024	314.0854	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1524.0992	
Space heating per m2											(98c) / (4) =	20.8781	(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	623.8288	491.0993	502.9090	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8779	0.9129	0.8975	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	547.6809	448.3362	451.3662	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1185.3920	1136.9159	1058.3677	0.0000	0.0000	0.0000	0.0000	(103)

Space cooling kWh
0.0000 0.0000 0.0000 0.0000 0.0000 459.1521 512.3033 451.6091 0.0000 0.0000 0.0000 0.0000 (104)
Cooled fraction fC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)
0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 (106)
Space cooling kWh
0.0000 0.0000 0.0000 0.0000 0.0000 114.7880 128.0758 112.9023 0.0000 0.0000 0.0000 0.0000 (107)
Space cooling requirement 355.7661 (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 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 1.0000 (306)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating:
Space heating requirement
306.9818 230.8819 190.4084 108.9546 54.7604 0.0000 0.0000 0.0000 0.0000 108.2243 209.8024 314.0854 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00
307a 306.9818 230.8819 190.4084 108.9546 54.7604 0.0000 0.0000 0.0000 0.0000 108.2243 209.8024 314.0854
Space heating requirement
306.9818 230.8819 190.4084 108.9546 54.7604 0.0000 0.0000 0.0000 0.0000 108.2243 209.8024 314.0854 (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
266.4432 235.9100 251.0588 221.4793 215.2660 194.5690 192.3258 199.5373 201.2828 223.7612 237.1349 263.6051 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00
310a 266.4432 235.9100 251.0588 221.4793 215.2660 194.5690 192.3258 199.5373 201.2828 223.7612 237.1349 263.6051
Water heating fuel
266.4432 235.9100 251.0588 221.4793 215.2660 194.5690 192.3258 199.5373 201.2828 223.7612 237.1349 263.6051 (310)
Cooling System Energy Efficiency Ratio 4.3000 (314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 26.6949 29.7851 26.2563 0.0000 0.0000 0.0000 0.0000 (315)
Pumps and Fa 18.0553 16.3080 18.0553 17.4728 18.0553 17.4728 18.0553 18.0553 17.4728 18.0553 17.4728 18.0553 (331)
Lighting 18.9213 15.1794 13.6673 10.0133 7.7345 6.3192 7.0557 9.1713 11.9126 15.6300 17.6540 19.4472 (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 1524.0992 (307)
Space heating fuel - secondary 0.0000 (309)
Water heating fuel - community heating 2702.3734 (310)
Efficiency of water heater 0.0000 (311)
Electricity used for heat distribution 15.2410 (313)
Space cooling fuel 82.7363 (321)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)
mechanical ventilation fans (SFP = 0.8680) 212.5862 (330a)
Total electricity for the above, kWh/year 212.5862 (331)
Electricity for lighting (calculated in Appendix L) 152.7057 (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 4674.5009 (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			350.0000	(367)
Space and Water heating from Heat pump	1207.5636	0.1552	67.5757	(367)
Electrical energy for heat distribution (space & water)	15.2410	0.0000	6.1700	(372)
Overall CO2 factor for heat network			0.0432	(386)
Total CO2 associated with community systems			182.4549	(373)
Space and water heating			182.4549	(376)
Space cooling	82.7363	0.1142	9.4502	(377)
Pumps, fans and electric keep-hot	212.5862	0.1387	29.4883	(378)
Energy for lighting	152.7057	0.1443	22.0402	(379)

Total CO2, kg/year	243.4336 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)	3.3300 (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			350.0000	(467a)
Space and Water heating from Heat pump	1207.5636	1.5745	685.6297	(467)
Electrical energy for heat distribution (space & water)	15.2410	0.0000	65.0895	(472)
Overall CO2 factor for heat network			0.4554	(486)
Total CO2 associated with community systems			1924.7890	(473)
Space and water heating			1924.7890	(476)
Space cooling	82.7363	1.4210	117.5645	(477)
Pumps, fans and electric keep-hot	212.5862	1.5128	321.6004	(478)
Energy for lighting	152.7057	1.5338	234.2251	(479)
Total Primary energy kWh/year			2598.1791	(483)
Dwelling Primary energy Rate (DPER)			35.5900	(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	73.0000	(1b)	x 2.7500	(2b) =	200.7500	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		200.7500	(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) =	0.1494 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3994 (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) =	0.3096 (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	0.3947	0.3870	0.3792	0.3405	0.3328	0.2941	0.2941	0.2863	0.3096	0.3328	0.3483	0.3637	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5432	0.5432	0.5410	0.5479	0.5554	0.5606	0.5662	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			16.2600	1.1450	18.6183			(27)
Heatloss Floor 1			73.0000	0.1300	9.4900			(28b)
External Wall 1	74.8600	18.2600	56.6000	0.1800	10.1880			(29a)
Total net area of external elements Aum(A, m2)			147.8600					(31)

Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	40.2963	(33)
Party Wall 1	10.4500	0.0000	0.0000	(32)
Corridor Wall	37.1300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 74.3364 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.0000	0.0900	0.9900
E17 Corner (inverted – internal area greater than external area)	2.7500	-0.0900	-0.2475
E20 Exposed floor (normal)	27.2200	0.3200	8.7104
E18 Party wall between dwellings	2.7500	0.0600	0.1650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.8600	0.0200	0.0972
E1 Steel lintel with perforated steel base plate	11.3900	0.0500	0.5695
E3 Sill	10.4400	0.0500	0.5220
E4 Jamb	41.0000	0.0500	2.0500
E7 Party floor between dwellings (in blocks of flats)	27.2200	0.0700	1.9054
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	17.3000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	17.3000	0.1600	2.7680

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.5300 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 57.8263 (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	38.2839	38.0836	37.8872	36.9646	36.7920	35.9885	35.9885	35.8397	36.2980	36.7920	37.1412	37.5062	(38)
Heat transfer coeff	96.1103	95.9099	95.7135	94.7909	94.6183	93.8149	93.8149	93.6661	94.1244	94.6183	94.9675	95.3326	(39)

Average = Sum(39)m / 12 = 94.7901

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3166	1.3138	1.3111	1.2985	1.2961	1.2851	1.2851	1.2831	1.2894	1.2961	1.3009	1.3059	(40)
HLP (average)												1.2985	
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 2.3167 (42)

Hot water usage for mixer showers

63.0631	62.1154	60.7344	58.0921	56.1421	53.9675	52.7315	54.1021	55.6045	57.9393	60.6384	62.8215	(42a)

Hot water usage for baths

27.2424	26.8378	26.2681	25.2176	24.4310	23.5588	23.0876	23.6534	24.2694	25.2027	26.2748	27.1503	(42b)

Hot water usage for other uses

38.3553	36.9606	35.5658	34.1711	32.7764	31.3816	31.3816	32.7764	34.1711	35.5658	36.9606	38.3553	(42c)

Average daily hot water use (litres/day) 118.2686 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.6609	125.9138	122.5683	117.4808	113.3495	108.9079	107.2008	110.5318	114.0450	118.7078	123.8738	128.3271	(44)
Energy conte	203.7674	179.2996	188.3830	160.8253	152.5902	133.9150	129.6500	136.8615	140.6288	161.0854	176.4809	200.9293	(45)
Energy content (annual)										Total = Sum(45)m =		1964.4164	
Distribution loss (46)m = 0.15 x (45)m	30.5651	26.8949	28.2574	24.1238	22.8885	20.0873	19.4475	20.5292	21.0943	24.1628	26.4721	30.1394	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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	252.3194	223.1530	236.9350	207.8111	201.1422	180.9008	178.2021	185.4135	187.6147	209.6374	223.4667	249.4813	(62)
WWHRS	-28.8298	-25.4973	-26.6993	-22.1081	-20.6040	-17.6310	-16.5262	-17.5740	-18.2417	-21.5049	-24.3625	-28.2959	(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	223.4896	197.6557	210.2356	185.7030	180.5382	163.2699	161.6759	167.8395	169.3730	188.1325	199.1043	221.1854	(64)
										Total per year (kWh/year) = Sum(64)m =		2268.2027	(64)
12Total per year (kWh/year)												2268	(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	106.5943	94.6999	101.4790	91.0631	89.5779	82.1154	81.9503	84.3481	84.3478	92.4025	96.2686	105.6506	(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	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	102.9950	114.0302	102.9950	106.4282	102.9950	106.4282	102.9950	102.9950	106.4282	102.9950	106.4282	102.9950	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(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)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	143.2719	140.9224	136.3964	126.4765	120.4003	114.0492	110.1482	113.3711	117.1497	124.1969	133.7063	142.0035	(72)
Total internal gains													
	511.2126	522.0172	501.1165	483.2624	459.4039	439.9996	423.6558	424.7598	437.3111	455.2926	482.5844	500.9346	(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	
Northeast	1.1500	11.2829	0.6300	0.7000	0.7700	3.9654	(75)
Southeast	9.1700	36.7938	0.6300	0.7000	0.7700	103.1137	(77)
Southwest	1.3900	36.7938	0.6300	0.7000	0.7700	15.6301	(79)
Northwest	4.5500	11.2829	0.6300	0.7000	0.7700	15.6894	(81)

Solar gains	138.3986	242.2725	348.8288	461.2818	543.2043	550.9459	526.3142	463.4123	387.4912	272.4383	166.9585	117.6710	(83)
Total gains	649.6112	764.2897	849.9453	944.5442	1002.6082	990.9455	949.9700	888.1721	824.8024	727.7309	649.5429	618.6056	(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	15.6838	15.7166	15.7489	15.9021	15.9311	16.0676	16.0676	16.0931	16.0147	15.9311	15.8726	15.8118	
alpha	2.0456	2.0478	2.0499	2.0601	2.0621	2.0712	2.0712	2.0729	2.0676	2.0621	2.0582	2.0541	
util living area													
	0.9001	0.8645	0.8172	0.7359	0.6286	0.4982	0.3871	0.4226	0.5909	0.7682	0.8668	0.9080	(86)
MIT	17.8449	18.2653	18.8517	19.5930	20.2217	20.6659	20.8591	20.8260	20.4934	19.6753	18.6448	17.7711	(87)
Th 2	19.8279	19.8300	19.8321	19.8420	19.8439	19.8525	19.8525	19.8541	19.8492	19.8439	19.8401	19.8362	(88)
util rest of house													
	0.8881	0.8488	0.7957	0.7042	0.5818	0.4307	0.2998	0.3344	0.5260	0.7330	0.8487	0.8969	(89)
MIT 2	16.2246	16.7436	17.4657	18.3659	19.1002	19.5891	19.7714	19.7481	19.4218	18.4889	17.2301	16.1359	(90)
Living area fraction										fLA = Living area / (4) =		0.5347	(91)
MIT	17.0909	17.5572	18.2067	19.0220	19.6998	20.1648	20.3529	20.3244	19.9948	19.1232	17.9865	17.0102	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0909	17.5572	18.2067	19.0220	19.6998	20.1648	20.3529	20.3244	19.9948	19.1232	17.9865	17.0102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8507	0.8100	0.7594	0.6785	0.5754	0.4500	0.3393	0.3721	0.5348	0.7073	0.8117	0.8605	(94)
Useful gains	552.6215	619.0807	645.4473	640.8559	576.9274	445.9218	322.3067	330.5135	441.1427	514.7385	527.2618	532.2998	(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													
	1229.3353	1213.9494	1120.4933	959.4734	756.9313	522.0650	352.0813	367.5836	554.8411	806.4537	1033.8616	1221.2269	(97)
Space heating kWh													
	503.4751	399.7518	353.4342	229.4046	133.9228	0.0000	0.0000	0.0000	0.0000	217.0361	364.7518	512.5618	(98a)
Space heating requirement - total per year (kWh/year)												2714.3381	
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													
	503.4751	399.7518	353.4342	229.4046	133.9228	0.0000	0.0000	0.0000	0.0000	217.0361	364.7518	512.5618	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2714.3381	
Space heating per m2											(98c) / (4) =	37.1827	(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													
	503.4751	399.7518	353.4342	229.4046	133.9228	0.0000	0.0000	0.0000	0.0000	217.0361	364.7518	512.5618	(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)													
	545.4768	433.1005	382.9190	248.5423	145.0952	0.0000	0.0000	0.0000	0.0000	235.1420	395.1808	555.3215	(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												
	223.4896	197.6557	210.2356	185.7030	180.5382	163.2699	161.6759	167.8395	169.3730	188.1325	199.1043	221.1854 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.8243	85.6057	85.2154	84.5349	83.3998	79.8000	79.8000	79.8000	79.8000	84.3811	85.3990	85.8803 (217)
Fuel for water heating, kWh/month												
	260.4037	230.8909	246.7108	219.6763	216.4731	204.5989	202.6013	210.3252	212.2469	222.9557	233.1459	257.5509 (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	21.4003	17.1681	15.4580	11.3252	8.7479	7.1471	7.9801	10.3729	13.4733	17.6778	19.9670	21.9951 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.8077	-20.8893	-32.1943	-38.8970	-44.3577	-42.2956	-41.7805	-38.2300	-32.4216	-25.0335	-15.6762	-11.7775 (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	-4.0067	-8.6884	-17.7668	-27.4360	-37.0293	-37.4853	-37.0460	-31.0200	-22.2868	-12.6671	-5.4251	-3.1496 (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	2940.7781 (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	2717.5797 (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)	172.7129 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-601.3680 (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	5315.7027 (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	2940.7781	0.2100	617.5634	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2717.5797	0.2100	570.6917	(264)
Space and water heating			1188.2551	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	172.7129	0.1443	24.9278	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-357.3608	0.1331	-47.5778	
PV Unit electricity exported	-244.0072	0.1251	-30.5233	
Total			-78.1011	(269)
Total CO2, kg/year			1147.0111	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.7100	(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	2940.7781	1.1300	3323.0792	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2717.5797	1.1300	3070.8650	(278)
Space and water heating			6393.9442	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	172.7129	1.5338	264.9129	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-357.3608	1.4920	-533.1708	
PV Unit electricity exported	-244.0072	0.4591	-112.0318	
Total			-645.2025	(283)
Total Primary energy kWh/year			6143.7554	(286)
Target Primary Energy Rate (TPER)			84.1600	(287)

Full SAP Calculation Printout

Property Reference	Flat 104 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 104 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	3.67	TER	17.37
Environmental	97 A	% DER < TER			78.87
CO_2 Emissions (t/year)	0.17	DFEE	41.22	TFEE	44.54
Compliance Check	See BREL	% DFEE < TFEE			7.46
% DPER < TPER	58.12	DPER	38.99	TPER	93.10

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 2.5800	(2b) =	134.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		134.1600	(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		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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Glazed Door (Uw = 0.95)			15.1600	0.9152	13.8748			(27)
Window (Uw = 0.95)			0.9000	0.9152	0.8237			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			52.0000	0.1200	6.2400	30.0000	1560.0000	(28b)
External Wall 1	50.3100	17.9500	32.3600	0.1500	4.8540	14.0000	453.0400	(29a)
Total net area of external elements Aum(A, m2)			102.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3045			(33)
Party Wall 1			23.2500	0.0000	0.0000	20.0000	465.0000	(32)
Party Ceiling 1			52.0000			30.0000	1560.0000	(32b)
Internal Wall 1			46.5400			9.0000	418.8600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4456.9000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.7096	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	19.5000	0.0700	1.3650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.4430	2.5251
E20 Exposed floor (normal)	19.5000	0.1250	2.4375
E16 Corner (normal)	7.7400	0.0900	0.6966
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	5.1600	0.0600	0.3096
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712
E1 Steel lintel with perforated steel base plate	8.0400	0.0500	0.4020
E3 Sill	7.1400	0.0500	0.3570
E4 Jamb	25.4000	0.0500	1.2700

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1018 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	38.4063 (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	9.9711	9.8424	9.7137	9.0704	8.9417	8.2984	8.2984	8.1697	8.5557	8.9417	9.1991	9.4564	(38)
Heat transfer coeff	48.3773	48.2487	48.1200	47.4766	47.3480	46.7046	46.7046	46.5760	46.9620	47.3480	47.6053	47.8627	(39)

Average = Sum(39)m / 12 = 47.4445

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9303	0.9279	0.9254	0.9130	0.9105	0.8982	0.8982	0.8957	0.9031	0.9105	0.9155	0.9204	(40)
HLP (average)												0.9124	
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												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
										Total per year (kWh/year) = Sum(64)m =		2405.8210	(64)
12Total per year (kWh/year)												2406	(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	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains													
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(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	
Northeast	13.1800	11.2829	0.4700	0.7000	0.7700	33.9052	(75)
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100	(77)
Southwest	0.9000	36.7938	0.4700	0.7000	0.7700	7.5500	(79)

Solar gains	58.0652	110.1685	180.6511	273.9755	352.6409	370.2215	348.5556	286.7900	212.4837	129.8252	71.5997	48.3646	(83)
Total gains	481.3196	541.2475	595.6645	674.6437	734.8764	739.5602	705.2938	644.6827	580.1329	509.3804	472.5028	463.8166	(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	25.5911	25.6593	25.7279	26.0766	26.1474	26.5076	26.5076	26.5808	26.3623	26.1474	26.0061	25.8663	
alpha	2.7061	2.7106	2.7152	2.7384	2.7432	2.7672	2.7672	2.7721	2.7575	2.7432	2.7337	2.7244	
util living area													
	0.8834	0.8458	0.7857	0.6713	0.5301	0.3839	0.2845	0.3217	0.5028	0.7203	0.8409	0.8915	(86)
MIT	19.2088	19.5053	19.9227	20.4268	20.7604	20.9288	20.9770	20.9674	20.8470	20.4078	19.7550	19.1645	(87)
Th 2	20.1418	20.1439	20.1460	20.1565	20.1586	20.1691	20.1691	20.1712	20.1649	20.1586	20.1544	20.1502	(88)
util rest of house													
	0.8714	0.8307	0.7654	0.6426	0.4927	0.3388	0.2330	0.2670	0.4532	0.6882	0.8231	0.8803	(89)
MIT 2	18.0582	18.4254	18.9380	19.5460	19.9258	20.1110	20.1547	20.1498	20.0318	19.5407	18.7492	18.0088	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	18.7171	19.0439	19.5019	20.0504	20.4038	20.5793	20.6256	20.6181	20.4986	20.0373	19.3252	18.6707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7171	19.0439	19.5019	20.0504	20.4038	20.5793	20.6256	20.6181	20.4986	20.0373	19.3252	18.6707	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8480	0.8087	0.7485	0.6388	0.5039	0.3613	0.2615	0.2968	0.4735	0.6832	0.8032	0.8571	(94)
Useful gains	408.1421	437.6866	445.8683	430.9397	370.2737	267.2151	184.4369	191.3346	274.7050	348.0168	379.5131	397.5418	(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													
	697.4629	682.4229	625.6534	529.3847	412.1070	279.2625	188.0154	196.4607	300.4932	446.8367	581.9834	692.6037	(97)
Space heating kWh													
	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98a)
Space heating requirement - total per year (kWh/year)												1054.3087	
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													
	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1054.3087	
Space heating per m2											(98c) / (4) =	20.2752	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98)

Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00

307a	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261
Space heating requirement												
	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (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	13.7900	12.4555	13.7900	13.3451	13.7900	13.3451	13.7900	13.7900	13.3451	13.7900	13.3451	13.7900 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (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	1054.3087 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	2405.8210 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	10.5431 (313)
Space cooling fuel	0.0000 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)	
mechanical ventilation fans (SFP = 0.9920)	162.3658 (330a)
Total electricity for the above, kWh/year	162.3658 (331)
Electricity for lighting (calculated in Appendix L)	136.3368 (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	3758.8322 (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			350.0000	(367)
Space and Water heating from Heat pump	988.6085	0.1555	46.8298	(367)
Electrical energy for heat distribution (space & water)	10.5431	0.0000	5.0240	(372)
Overall CO2 factor for heat network			0.0429	(386)
Total CO2 associated with community systems			148.5672	(373)
Space and water heating			148.5672	(376)
Pumps, fans and electric keep-hot	162.3658	0.1387	22.5221	(378)
Energy for lighting	136.3368	0.1443	19.6776	(379)
Total CO2, kg/year			190.7670	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6700	(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			350.0000	(467a)
Space and Water heating from Heat pump	988.6085	1.5755	474.6033	(467)
Electrical energy for heat distribution (space & water)	10.5431	0.0000	53.1855	(472)
Overall CO2 factor for heat network			0.4545	(486)
Total CO2 associated with community systems			1572.7703	(473)
Space and water heating			1572.7703	(476)
Pumps, fans and electric keep-hot	162.3658	1.5128	245.6270	(478)
Energy for lighting	136.3368	1.5338	209.1179	(479)
Total Primary energy kWh/year			2027.5152	(483)
Dwelling Primary energy Rate (DPER)			38.9900	(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	52.0000 (1b)	x	2.5800 (2b)	=	134.1600 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		134.1600	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1491 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3991 (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) =	0.3093 (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	0.3943	0.3866	0.3789	0.3402	0.3325	0.2938	0.2938	0.2861	0.3093	0.3325	0.3479	0.3634	(22b)
Effective ac	0.5778	0.5747	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5605	0.5660	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099			(27)
Heatloss Floor 1			52.0000	0.1300	6.7600			(28b)
External Wall 1	50.3100	12.9900	37.3200	0.1800	6.7176			(29a)
Total net area of external elements Aum(A, m2)			102.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.0775			(33)
Party Wall 1			23.2500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 95.7096 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	19.5000	0.0700	1.3650
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.0200	0.1140
E20	Exposed floor (normal)	19.5000	0.3200	6.2400
E16	Corner (normal)	7.7400	0.0900	0.6966
E17	Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18	Party wall between dwellings	5.1600	0.0600	0.3096
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7	Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712
E1	Steel lintel with perforated steel base plate	8.0400	0.0500	0.4020
E3	Sill	7.1400	0.0500	0.3570
E4	Jamb	25.4000	0.0500	1.2700

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4932 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.5707 (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	25.5786	25.4450	25.3140	24.6986	24.5834	24.0474	24.0474	23.9482	24.2539	24.5834	24.8163	25.0599	(38)
Heat transfer coeff	66.1494	66.0157	65.8847	65.2693	65.1541	64.6182	64.6182	64.5189	64.8246	65.1541	65.3871	65.6306	(39)

Average = Sum(39)m / 12 = 65.2687

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2695	1.2670	1.2552	1.2530	1.2427	1.2427	1.2407	1.2466	1.2530	1.2574	1.2621	(40)
HLP (average)												1.2552	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491 (42)
Hot water usage for mixer showers												
	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths												
	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses												
	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m													
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
										Total per year (kWh/year) = Sum(64)m =		2012.0777	(64)
12Total per year (kWh/year)												2012	(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													
	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0119	85.2631	77.0119	79.5789	77.0119	79.5789	77.0119	77.0119	79.5789	77.0119	79.5789	77.0119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains													
	411.1980	419.0366	402.9570	388.6162	370.1790	354.2867	341.6819	342.8363	352.5972	367.4989	388.8511	403.3956	(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	
Northeast	9.1100	11.2829	0.6300	0.7000	0.7700	31.4132	(75)
Southeast	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052	(77)
Southwest	0.6200	36.7938	0.6300	0.7000	0.7700	6.9717	(79)

Solar gains	53.7901	102.0587	167.3563	253.8173	326.6983	342.9869	322.9142	265.6903	196.8478	120.2693	66.3283	44.8036	(83)
Total gains	464.9881	521.0952	570.3132	642.4335	696.8773	697.2735	664.5961	608.5266	549.4450	487.7682	455.1794	448.1992	(84)

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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	20.8993	20.9416	20.9832	21.1811	21.2185	21.3945	21.3945	21.4274	21.3263	21.2185	21.1429	21.0645	
alpha	2.3933	2.3961	2.3989	2.4121	2.4146	2.4263	2.4263	2.4285	2.4218	2.4146	2.4095	2.4043	
util living area	0.9229	0.8986	0.8586	0.7758	0.6563	0.5115	0.3948	0.4399	0.6321	0.8122	0.8958	0.9285	(86)
MIT	18.3938	18.7041	19.2004	19.8694	20.4230	20.7784	20.9145	20.8867	20.6108	19.9071	19.0570	18.3427	(87)
Th 2	19.8628	19.8648	19.8668	19.8761	19.8779	19.8860	19.8860	19.8875	19.8829	19.8779	19.8743	19.8706	(88)
util rest of house	0.9122	0.8848	0.8389	0.7444	0.6077	0.4414	0.3056	0.3483	0.5646	0.7785	0.8794	0.9186	(89)
MIT 2	16.8663	17.2545	17.8722	18.6901	19.3331	19.7171	19.8397	19.8220	19.5599	18.7579	17.7101	16.8070	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	17.7411	18.0847	18.6329	19.3655	19.9573	20.3249	20.4553	20.4317	20.1618	19.4160	18.4815	17.6865	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7411	18.0847	18.6329	19.3655	19.9573	20.3249	20.4553	20.4317	20.1618	19.4160	18.4815	17.6865	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8863	0.8577	0.8132	0.7283	0.6114	0.4702	0.3524	0.3946	0.5826	0.7624	0.8539	0.8934	(94)
Useful gains	412.1128	446.9366	463.8046	467.8682	426.0651	327.8243	234.2013	240.1310	320.1266	371.8860	388.6633	400.4013	(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	889.1192	870.3943	799.3691	683.0737	537.9948	369.9316	249.1209	260.1229	392.9523	574.4020	744.1997	885.1270	(97)
Space heating kWh	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359	(98a)
Space heating requirement - total per year (kWh/year)												1894.6340	
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	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1894.6340	
Space heating per m2										(98c) / (4) =		36.4353	(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	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359	(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)	384.4992	308.3029	270.4876	167.8743	90.2228	0.0000	0.0000	0.0000	0.0000	163.2415	277.3415	390.7214	(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	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.3626	85.1504	84.7227	83.9223	82.6606	79.8000	79.8000	79.8000	79.8000	83.8290	84.8972	85.4177	(217)
Fuel for water heating, kWh/month	230.8724	204.8569	219.3356	196.3264	194.3045	182.6008	181.2006	187.7579	189.0926	199.2862	207.4728	228.4330	(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	16.0015	12.8370	11.5583	8.4681	6.5410	5.3441	5.9669	7.7561	10.0743	13.2181	14.9298	16.4463	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6273	-17.4948	-26.8232	-32.2447	-36.6427	-34.9104	-34.5013	-31.6395	-26.9257	-20.9109	-13.1731	-9.9292	(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	-3.6003	-7.7880	-15.8832	-24.4564	-32.9265	-33.2859	-32.8791	-27.5550	-19.8388	-11.3153	-4.8642	-2.8304	(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	2052.6912 (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	2421.5399 (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)	129.1416 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.0461 (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	4175.3267 (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	2052.6912	0.2100	431.0651	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2421.5399	0.2100	508.5234	(264)
Space and water heating			939.5885	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.1416	0.1443	18.6391	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8229	0.1332	-39.5451	
PV Unit electricity exported	-217.2232	0.1252	-27.1935	
Total			-66.7387	(269)
Total CO2, kg/year			903.4183	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.3700	(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	2052.6912	1.1300	2319.5410	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2421.5399	1.1300	2736.3401	(278)
Space and water heating			5055.8811	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.1416	1.5338	198.0817	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8229	1.4923	-442.9520	
PV Unit electricity exported	-217.2232	0.4595	-99.8117	
Total			-542.7636	(283)
Total Primary energy kWh/year			4841.3000	(286)
Target Primary Energy Rate (TPER)			93.1000	(287)

Full SAP Calculation Printout

Property Reference	Flat 105 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 105 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	3.84	TER	18.62
Environmental	97 A	% DER < TER			79.38
CO_2 Emissions (t/year)	0.18	DFEE	45.29	TFEE	50.17
Compliance Check	See BREL	% DFEE < TFEE			9.73
% DPER < TPER	59.19	DPER	40.74	TPER	99.83

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	52.0000	(1b)	x 2.5800	(2b) =	134.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		134.1600	(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) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(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	
Glazed Door (Uw = 0.95)			17.1000	0.9152	15.6503			(27)
Window (Uw = 0.95)			1.8000	0.9152	1.6474			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			52.0000	0.1200	6.2400	30.0000	1560.0000	(28b)
External Wall 1	74.4300	20.7900	53.6400	0.1500	8.0460	14.0000	750.9600	(29a)
Total net area of external elements Aum(A, m2)			126.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.0957			(33)
Party Wall 1			9.0300	0.0000	0.0000	20.0000	180.6000	(32)
Party Ceiling 1			52.0000			30.0000	1560.0000	(32b)
Internal Wall 1			52.8900			9.0000	476.0100	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4527.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		87.0687 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	28.8500	0.0700	2.0195
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.4430	1.9049
E20 Exposed floor (normal)	28.8500	0.1250	3.6063
E16 Corner (normal)	10.3200	0.0900	0.9288
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	2.5800	0.0600	0.1548
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5000	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	3.5000	0.1600	0.5600
E1 Steel lintel with perforated steel base plate	9.6000	0.0500	0.4800
E3 Sill	8.7000	0.0500	0.4350
E4 Jamb	25.4000	0.0500	1.2700

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1271 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	44.2227 (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	9.9711	9.8424	9.7137	9.0704	8.9417	8.2984	8.2984	8.1697	8.5557	8.9417	9.1991	9.4564	(38)
Heat transfer coeff	54.1938	54.0651	53.9365	53.2931	53.1645	52.5211	52.5211	52.3925	52.7785	53.1645	53.4218	53.6791	(39)

Average = Sum(39)m / 12 = 53.2610

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0422	1.0397	1.0372	1.0249	1.0224	1.0100	1.0100	1.0075	1.0150	1.0224	1.0273	1.0323	(40)
HLP (average)												1.0242	
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												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)

Energy content (annual) Total = Sum(45)m = 1667.8640

Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.2714	(55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(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	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)

Total per year (kWh/year) = Sum(64)m = 2405.8210 (64)

12Total per year (kWh/year) 2406 (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	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains													
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(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	
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175	(75)
Southeast	5.8200	36.7938	0.4700	0.7000	0.7700	48.8233	(77)
Northwest	1.8000	11.2829	0.4700	0.7000	0.7700	4.6305	(81)

Solar gains	82.4713	151.6556	237.1887	343.6478	430.3325	447.1985	422.8332	355.1083	273.5739	175.6161	100.8169	69.2612	(83)
Total gains	505.7257	582.7346	652.2020	744.3160	812.5679	816.5372	779.5714	713.0009	641.2231	555.1714	501.7201	484.7132	(84)

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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	23.2067	23.2619	23.3174	23.5989	23.6560	23.9458	23.9458	24.0046	23.8290	23.6560	23.5420	23.4292	
alpha	2.5471	2.5508	2.5545	2.5733	2.5771	2.5964	2.5964	2.6003	2.5886	2.5771	2.5695	2.5619	
util living area													
	0.8852	0.8436	0.7804	0.6668	0.5288	0.3864	0.2874	0.3244	0.5026	0.7190	0.8428	0.8941	(86)
MIT	18.9731	19.3194	19.7874	20.3372	20.7107	20.9076	20.9685	20.9564	20.8124	20.3132	19.5747	18.9160	(87)
Th 2	20.0483	20.0504	20.0524	20.0627	20.0647	20.0750	20.0750	20.0770	20.0709	20.0647	20.0606	20.0565	(88)
util rest of house													
	0.8727	0.8274	0.7583	0.6357	0.4880	0.3366	0.2300	0.2636	0.4484	0.6842	0.8238	0.8824	(89)
MIT 2	17.7045	18.1323	18.7055	19.3655	19.7887	20.0019	20.0563	20.0498	19.9120	19.3578	18.4645	17.6391	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	18.4918	18.8690	19.3769	19.9685	20.3609	20.5639	20.6224	20.6124	20.4708	19.9507	19.1535	18.4315	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4918	18.8690	19.3769	19.9685	20.3609	20.5639	20.6224	20.6124	20.4708	19.9507	19.1535	18.4315	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8479	0.8041	0.7409	0.6323	0.5013	0.3633	0.2643	0.2993	0.4723	0.6796	0.8027	0.8579	(94)
Useful gains	428.8066	468.5770	483.2010	470.6670	407.3213	296.6597	206.0230	213.3707	302.8770	377.3026	402.7515	415.8581	(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													
	769.1060	755.2346	694.5336	589.8737	460.4519	313.2333	211.2626	220.6999	336.2397	497.1256	643.9172	763.9347	(97)
Space heating kWh													
	253.1828	192.6339	157.2314	85.8288	39.5292	0.0000	0.0000	0.0000	0.0000	89.1484	173.6393	258.9690	(98a)
Space heating requirement - total per year (kWh/year)												1250.1627	
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													
	253.1828	192.6339	157.2314	85.8288	39.5292	0.0000	0.0000	0.0000	0.0000	89.1484	173.6393	258.9690	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1250.1627	
Space heating per m2											(98c) / (4) =	24.0416	(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	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	253.1828	192.6339	157.2314	85.8288	39.5292	0.0000	0.0000	0.0000	0.0000	89.1484	173.6393	258.9690	(98)

Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00

307a	253.1828	192.6339	157.2314	85.8288	39.5292	0.0000	0.0000	0.0000	0.0000	89.1484	173.6393	258.9690
Space heating requirement												
	253.1828	192.6339	157.2314	85.8288	39.5292	0.0000	0.0000	0.0000	0.0000	89.1484	173.6393	258.9690 (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												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (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	13.7900	12.4555	13.7900	13.3451	13.7900	13.3451	13.7900	13.7900	13.3451	13.7900	13.3451	13.7900 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (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	1250.1627 (307)
Space heating fuel - secondary	0.0000 (309)
Water heating fuel - community heating	2405.8210 (310)
Efficiency of water heater	0.0000 (311)
Electricity used for heat distribution	12.5016 (313)
Space cooling fuel	0.0000 (321)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)	
mechanical ventilation fans (SFP = 0.9920)	162.3658 (330a)
Total electricity for the above, kWh/year	162.3658 (331)
Electricity for lighting (calculated in Appendix L)	136.3368 (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	3954.6863 (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			350.0000	(367)
Space and Water heating from Heat pump	1044.5668	0.1553	55.4839	(367)
Electrical energy for heat distribution (space & water)	12.5016	0.0000	5.3269	(372)
Overall CO2 factor for heat network			0.0431	(386)
Total CO2 associated with community systems			157.5242	(373)
Space and water heating			157.5242	(376)
Pumps, fans and electric keep-hot	162.3658	0.1387	22.5221	(378)
Energy for lighting	136.3368	0.1443	19.6776	(379)
Total CO2, kg/year			199.7239	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8400	(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			350.0000	(467a)
Space and Water heating from Heat pump	1044.5668	1.5751	562.5991	(467)
Electrical energy for heat distribution (space & water)	12.5016	0.0000	56.2653	(472)
Overall CO2 factor for heat network			0.4551	(486)
Total CO2 associated with community systems			1663.8460	(473)
Space and water heating			1663.8460	(476)
Pumps, fans and electric keep-hot	162.3658	1.5128	245.6270	(478)
Energy for lighting	136.3368	1.5338	209.1179	(479)
Total Primary energy kWh/year			2118.5909	(483)
Dwelling Primary energy Rate (DPER)			40.7400	(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	52.0000 (1b)	x	2.5800 (2b)	=	134.1600 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	134.1600	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1491 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3991 (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) =	0.3093 (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	0.3943	0.3866	0.3789	0.3402	0.3325	0.2938	0.2938	0.2861	0.3093	0.3325	0.3479	0.3634	(22b)
Effective ac	0.5778	0.5747	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5605	0.5660	(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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
Heatloss Floor 1			52.0000	0.1300	6.7600			(28b)
External Wall 1	74.4300	13.0000	61.4300	0.1800	11.0574			(29a)
Total net area of external elements Aum(A, m2)			126.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.4288			(33)
Party Wall 1			9.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.0687 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	28.8500	0.0700	2.0195
E23	Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.0200	0.0860
E20	Exposed floor (normal)	28.8500	0.3200	9.2320
E16	Corner (normal)	10.3200	0.0900	0.9288
E17	Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18	Party wall between dwellings	2.5800	0.0600	0.1548
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	3.5000	0.0000	0.0000
P7	Party Wall - Exposed floor (normal)	3.5000	0.1600	0.5600
E1	Steel lintel with perforated steel base plate	9.6000	0.0500	0.4800
E3	Sill	8.7000	0.0500	0.4350
E4	Jamb	25.4000	0.0500	1.2700

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.9339 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 47.3627 (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	25.5786	25.4450	25.3140	24.6986	24.5834	24.0474	24.0474	23.9482	24.2539	24.5834	24.8163	25.0599	(38)
Heat transfer coeff	72.9413	72.8076	72.6766	72.0612	71.9461	71.4101	71.4101	71.3108	71.6166	71.9461	72.1790	72.4225	(39)

Average = Sum(39)m / 12 = 72.0607

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4027	1.4001	1.3976	1.3858	1.3836	1.3733	1.3733	1.3714	1.3772	1.3836	1.3881	1.3927	(40)
HLP (average)												1.3858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491 (42)
Hot water usage for mixer showers												
	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths												
	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses												
	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	(44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958	(45)
Energy content (annual)										Total = Sum(45)m =		1667.8640	
Distribution loss (46)m = 0.15 x (45)m													
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage													
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(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													
	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
										Total per year (kWh/year) = Sum(64)m =		2012.0777	(64)
12Total per year (kWh/year)												2012	(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													
	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(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	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(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)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains													
	411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917	(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	
Northeast	6.6300	11.2829	0.6300	0.7000	0.7700	22.8617	(75)
Southeast	3.4200	36.7938	0.6300	0.7000	0.7700	38.4568	(77)
Northwest	1.0600	11.2829	0.6300	0.7000	0.7700	3.6551	(81)

Solar gains	64.9735	119.4818	186.8753	270.7613	339.0677	352.3596	333.1604	279.7938	215.5454	138.3607	79.4273	54.5659	(83)
Total gains	476.1676	538.5140	589.8283	659.3734	709.2427	706.6422	674.8383	622.6261	568.1386	505.8557	468.2743	457.9576	(84)

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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	19.2223	19.2576	19.2923	19.4571	19.4882	19.6345	19.6345	19.6618	19.5779	19.4882	19.4254	19.3600	
alpha	2.2815	2.2838	2.2862	2.2971	2.2992	2.3090	2.3090	2.3108	2.3052	2.2992	2.2950	2.2907	
util living area													
	0.9251	0.9008	0.8628	0.7869	0.6764	0.5374	0.4193	0.4624	0.6475	0.8184	0.8990	0.9307	(86)
MIT	18.1499	18.4795	18.9995	19.6987	20.3015	20.7139	20.8844	20.8515	20.5333	19.7672	18.8555	18.0933	(87)
Th 2	19.7613	19.7632	19.7652	19.7742	19.7759	19.7839	19.7839	19.7854	19.7808	19.7759	19.7725	19.7689	(88)
util rest of house													
	0.9141	0.8865	0.8424	0.7543	0.6250	0.4603	0.3183	0.3599	0.5752	0.7832	0.8820	0.9205	(89)
MIT 2	16.5052	16.9171	17.5647	18.4206	19.1240	19.5707	19.7242	19.7031	19.4013	18.5267	17.4022	16.4383	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	17.5258	17.8867	18.4551	19.2138	19.8547	20.2802	20.4442	20.4158	20.1038	19.2966	18.3041	17.4654	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5258	17.8867	18.4551	19.2138	19.8547	20.2802	20.4442	20.4158	20.1038	19.2966	18.3041	17.4654	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8878	0.8587	0.8160	0.7372	0.6286	0.4933	0.3749	0.4152	0.5959	0.7670	0.8561	0.8950	(94)
Useful gains	422.7422	462.4474	481.3042	486.1019	445.8070	348.5728	253.0100	258.5416	338.5761	387.9796	400.8840	409.8504	(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													
	964.7093	945.5291	868.8541	743.2222	586.6998	405.6216	274.5152	286.3685	429.9713	625.6842	808.7003	960.7125	(97)
Space heating kWh													
	403.2236	324.6309	288.3372	185.1266	104.8242	0.0000	0.0000	0.0000	0.0000	176.8522	293.6277	409.8414	(98a)
Space heating requirement - total per year (kWh/year)												2186.4638	
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													
	403.2236	324.6309	288.3372	185.1266	104.8242	0.0000	0.0000	0.0000	0.0000	176.8522	293.6277	409.8414	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2186.4638	
Space heating per m2											(98c) / (4) =	42.0474	(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													
	403.2236	324.6309	288.3372	185.1266	104.8242	0.0000	0.0000	0.0000	0.0000	176.8522	293.6277	409.8414	(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)													
	436.8619	351.7128	312.3913	200.5705	113.5690	0.0000	0.0000	0.0000	0.0000	191.6059	318.1232	444.0319	(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													
	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6295	85.4323	85.0412	84.3218	83.1271	79.8000	79.8000	79.8000	79.8000	84.1877	85.1972	85.6832	(217)
Fuel for water heating, kWh/month													
	230.1529	204.1810	218.5142	195.3962	193.2139	182.6008	181.2006	187.7579	189.0926	198.4370	206.7421	227.7253	(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	16.0007	12.8364	11.5577	8.4677	6.5407	5.3438	5.9666	7.7557	10.0738	13.2174	14.9290	16.4454	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6273	-17.4948	-26.8232	-32.2447	-36.6426	-34.9104	-34.5013	-31.6395	-26.9257	-20.9109	-13.1731	-9.9292	(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	-3.6003	-7.7880	-15.8832	-24.4564	-32.9265	-33.2859	-32.8792	-27.5550	-19.8388	-11.3154	-4.8642	-2.8304	(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	2368.8665 (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	2415.0146 (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)	129.1350 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-514.0461 (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	4484.9701 (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	2368.8665	0.2100	497.4620	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2415.0146	0.2100	507.1531	(264)
Space and water heating			1004.6150	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.1350	0.1443	18.6382	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8227	0.1332	-39.5451	
PV Unit electricity exported	-217.2234	0.1252	-27.1935	
Total			-66.7387	(269)
Total CO2, kg/year			968.4438	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.6200	(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	2368.8665	1.1300	2676.8192	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2415.0146	1.1300	2728.9665	(278)
Space and water heating			5405.7857	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.1350	1.5338	198.0716	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8227	1.4923	-442.9517	
PV Unit electricity exported	-217.2234	0.4595	-99.8118	
Total			-542.7634	(283)
Total Primary energy kWh/year			5191.1947	(286)
Target Primary Energy Rate (TPER)			99.8300	(287)

Full SAP Calculation Printout

Property Reference	Flat 201 VL - Be Green	Issued on Date	06/05/2023
Assessment Reference	Flat 201 VL - Be Green	Prop Type Ref	Flat 103 VL - Be Green
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	86 B	DER	2.56	TER	11.86
Environmental	98 A	% DER < TER			78.41
CO_2 Emissions (t/year)	0.21	DFEE	29.24	TFEE	31.69
Compliance Check	See BREL	% DFEE < TFEE			7.75
% DPER < TPER	56.65	DPER	27.30	TPER	62.97

Assessor Details	Mr. Adrian Fell	Assessor ID	N222-0001
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	88.0000 (1b)	x	2.5800 (2b)	=	227.0400	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.0400	(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) =	83.7000 (23c)

Effective ac	0.2297	0.2268	0.2239	0.2094	0.2065	0.1919	0.1919	0.1890	0.1977	0.2065	0.2123	0.2181	(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	
Glazed Door (Uw = 0.95)			13.2600	0.9152	12.1358			(27)
Window (Uw = 0.95)			3.6000	0.9152	3.2948			(27)
Door			1.8900	0.8000	1.5120			(26)