Full SAP Calculation Printout

Property Reference	1.F Flat - 10-12 MS Lean	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	29.77	TER	17.22
Environmental	79 C	% DER < TER			-72.88
CO_2 Emissions (t/year)	1.28	DFEE	86.40	TFEE	43.84
Compliance Check	See BREL	% DFEE < TFEE			-97.08
% DPER < TPER	-81.36	DPER	166.55	TPER	91.83

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	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)

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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)			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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(64)
										Total per year (kWh/year) = Sum(64)m =		2252.8297	(64)
12Total per year (kWh/year)												2253	(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	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	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)	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains	375.9843	383.8089	367.7433	353.3547	334.3213	317.7789	304.9301	306.5688	316.8360	332.2852	353.6331	368.1820	(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	11.7600	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	453.0740	528.3768	600.7567	701.0856	777.6760	781.6219	742.2638	668.9403	589.0046	501.5568	448.3827	432.5927	(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	0.9914	0.9850	0.9710	0.9291	0.8387	0.6853	0.5416	0.6057	0.8289	0.9554	0.9856	0.9926	(86)
MIT	18.6756	18.9262	19.3473	19.9622	20.4828	20.8290	20.9437	20.9178	20.6417	19.9710	19.2467	18.6690	(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	0.9882	0.9794	0.9597	0.9000	0.7705	0.5577	0.3642	0.4260	0.7284	0.9310	0.9793	0.9900	(89)
MIT 2	17.3063	17.5586	17.9771	18.5894	19.0556	19.3387	19.3954	19.3946	19.2163	18.6172	17.9011	17.3175	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	17.9475	18.1990	18.6187	19.2322	19.7239	20.0365	20.1204	20.1079	19.8838	19.2512	18.5312	17.9504	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9475	18.1990	18.6187	19.2322	19.7239	20.0365	20.1204	20.1079	19.8838	19.2512	18.5312	17.9504	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9845	0.9742	0.9532	0.8970	0.7875	0.6127	0.4481	0.5106	0.7645	0.9286	0.9748	0.9867	(94)
Useful gains	446.0355	514.7550	572.6637	628.9067	612.4343	478.9111	332.6172	341.5510	450.3056	465.7549	437.0867	426.8204	(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	1434.8239	1391.3039	1261.5629	1048.8830	810.4032	535.0274	346.4564	362.9895	575.1796	873.7542	1166.3515	1417.2036	(97)
Space heating kWh	735.6586	589.0409	512.5410	302.3830	147.2888	0.0000	0.0000	0.0000	0.0000	303.5515	525.0707	736.8451	(98a)
Space heating requirement - total per year (kWh/year)												3852.3796	
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	735.6586	589.0409	512.5410	302.3830	147.2888	0.0000	0.0000	0.0000	0.0000	303.5515	525.0707	736.8451	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3852.3796	
Space heating per m2											(98c) / (4) =	74.0842	(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	0.7547	0.8246	0.7785	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	698.1351	600.5499	579.2509	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	878.5244	834.3894	749.4351	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	129.8803	173.9766	126.6171	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	32.4701	43.4941	31.6543	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												107.6185	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	735.6586	589.0409	512.5410	302.3830	147.2888	0.0000	0.0000	0.0000	0.0000	303.5515	525.0707	736.8451	(98)

Space heating efficiency (main heating system 1)
84.4000 84.4000 84.4000 84.4000 84.4000 0.0000 0.0000 0.0000 0.0000 84.4000 84.4000 84.4000 (210)
Space heating fuel (main heating system)
871.6334 697.9157 607.2761 358.2736 174.5128 0.0000 0.0000 0.0000 0.0000 359.6582 622.1216 873.0392 (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
223.9644 198.2597 210.9038 185.7371 178.5977 159.3002 156.4598 164.0232 167.1496 187.7259 199.1535 221.5547 (64)
Efficiency of water heater
89.4000 (216)
(217)m 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 (217)
Fuel for water heating, kWh/month
250.5195 221.7670 235.9103 207.7597 199.7737 178.1882 175.0110 183.4711 186.9682 209.9842 222.7668 247.8241 (219)
Space cooling fuel requirement
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 7.5512 10.1149 7.3615 0.0000 0.0000 0.0000 0.0000 (221)
Pumps and Fa 24.9658 22.5498 24.9658 24.1605 24.9658 24.1605 24.9658 24.9658 24.1605 24.9658 24.1605 24.9658 (231)
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 (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 4564.4308 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.4000
Water heating fuel used 2519.9437 (219)
Space cooling fuel 25.0276 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 207.9525 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 293.9525 (231)
Electricity for lighting (calculated in Appendix L) 113.9905 (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 7517.3450 (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	4564.4308	0.2100	958.5305	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2519.9437	0.2100	529.1882	(264)
Space and water heating			1487.7186	(265)
Space cooling	25.0276	0.1140	2.8534	(266)
Pumps, fans and electric keep-hot	293.9525	0.1387	40.7748	(267)
Energy for lighting	113.9905	0.1443	16.4523	(268)
Total CO2, kg/year			1547.7992	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			29.7700	(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	4564.4308	1.1300	5157.8068	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2519.9437	1.1300	2847.5364	(278)
Space and water heating			8005.3432	(279)
Space cooling	25.0276	1.4202	35.5450	(280)
Pumps, fans and electric keep-hot	293.9525	1.5128	444.6914	(281)
Energy for lighting	113.9905	1.5338	174.8424	(282)

Total Primary energy kWh/year 8660.4220 (286)
Dwelling Primary energy Rate (DPER) 166.5500 (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	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)

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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) =	0.1237	(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)

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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)
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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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													
	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	0.0000	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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1109	383.9490	367.8698	353.4854	334.4478	317.9096	305.0567	306.6953	316.9668	332.4117	353.7638	368.3085	(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	433.6778	491.9026	541.8619	613.1282	665.4835	664.2403	631.5951	577.2671	520.1931	458.8107	424.5178	416.4077	(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												
	0.9920	0.9847	0.9673	0.9087	0.7794	0.5901	0.4393	0.4977	0.7528	0.9407	0.9845	0.9933 (86)
MIT	19.6607	19.8536	20.1490	20.5471	20.8377	20.9666	20.9933	20.9883	20.8981	20.5173	20.0263	19.6301 (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												
	0.9894	0.9797	0.9565	0.8796	0.7182	0.4988	0.3321	0.3837	0.6655	0.9152	0.9786	0.9912 (89)
MIT 2	18.3434	18.5891	18.9606	19.4470	19.7614	19.8808	19.8964	19.8962	19.8302	19.4259	18.8173	18.3103 (90)
Living area fraction										fLA = Living area / (4) =		0.4683 (91)
MIT	18.9603	19.1812	19.5171	19.9621	20.2654	20.3892	20.4101	20.4076	20.3303	19.9370	19.3834	18.9283 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9603	19.1812	19.5171	19.9621	20.2654	20.3892	20.4101	20.4076	20.3303	19.9370	19.3834	18.9283 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9865	0.9758	0.9522	0.8818	0.7403	0.5406	0.3824	0.4372	0.7023	0.9165	0.9751	0.9886	(94)
Useful gains	427.8237	479.9892	515.9592	540.6421	492.6861	359.0970	241.5461	252.3929	365.3526	420.4890	413.9646	411.6711	(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													
	959.2040	932.3850	848.0513	713.4918	551.4154	369.4137	243.1225	255.3044	398.9161	601.0857	793.7926	955.5807	(97)
Space heating kWh													
	395.3469	304.0100	247.0765	124.4517	43.6946	0.0000	0.0000	0.0000	0.0000	134.3640	273.4762	404.6687	(98a)
Space heating requirement - total per year (kWh/year)												1927.0886	
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													
	395.3469	304.0100	247.0765	124.4517	43.6946	0.0000	0.0000	0.0000	0.0000	134.3640	273.4762	404.6687	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1927.0886	
Space heating per m2											(98c) / (4) =	37.0594	(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 %)	92.4000 (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													
	395.3469	304.0100	247.0765	124.4517	43.6946	0.0000	0.0000	0.0000	0.0000	134.3640	273.4762	404.6687	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	427.8646	329.0151	267.3988	134.6880	47.2886	0.0000	0.0000	0.0000	0.0000	145.4155	295.9699	437.9532	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8177	85.5338	84.9652	83.7604	81.9923	80.3000	80.3000	80.3000	80.3000	83.8888	85.2928	85.8830	(217)
Fuel for water heating, kWh/month													
	232.4528	206.4801	221.5424	199.3372	196.4859	179.7386	177.3695	185.6805	188.8679	202.0132	209.2413	229.9981	(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												2085.5937	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2429.2077	(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	4087.3789 (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	2085.5937	0.2100	437.9747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2429.2077	0.2100	510.1336	(264)
Space and water heating			948.1083	(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			895.3175	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.2200	(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	2085.5937	1.1300	2356.7209	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2429.2077	1.1300	2745.0047	(278)
Space and water heating			5101.7256	(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			4775.1757	(286)
Target Primary Energy Rate (TPER)			91.8300	(287)

Full SAP Calculation Printout

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

SAP Rating	85 B	DER	11.59	TER	12.74
Environmental	89 B	% DER < TER			9.03
CO_2 Emissions (t/year)	1.37	DFEE	43.75	TFEE	46.87
Compliance Check	See BREL	% DFEE < TFEE			6.65
% DPER < TPER	1.41	DPER	66.52	TPER	67.47

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)

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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) =	0.1018	(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)

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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)			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	2168.0748	(97)
Space heating kWh													
	1068.9697	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													
	1068.9697	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	70.9502	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	786.6741	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	1391.7534	934.5151	600.7767	631.3009	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)												6131.2399	
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)												6131.2399	
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 Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 402 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	16.42	TER	17.51
Environmental	88 B	% DER < TER			6.23
CO_2 Emissions (t/year)	0.77	DFEE	40.96	TFEE	44.98
Compliance Check	See BREL	% DFEE < TFEE			8.93
% DPER < TPER	-0.54	DPER	93.89	TPER	93.39

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	17.8167	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)												2194.7901	
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)												2194.7901	
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	617.9063	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 - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 402 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	82 B	DER	18.41	TER	18.41
Environmental	87 B	% DER < TER			0.00
CO_2 Emissions (t/year)	0.86	DFEE	49.46	TFEE	47.56
Compliance Check	See BREL	% DFEE < TFEE			-3.99
% DPER < TPER	-5.61	DPER	104.22	TPER	98.69

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 Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 403 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	18.00	TER	19.60
Environmental	87 B	% DER < TER			8.16
CO_2 Emissions (t/year)	0.84	DFEE	48.23	TFEE	54.42
Compliance Check	See BREL	% DFEE < TFEE			11.38
% DPER < TPER	2.17	DPER	102.38	TPER	104.65

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	934.0202	919.7178	849.0161	731.5839	579.2073	401.8933	272.2272	283.5818	423.0430	610.6447	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	669.5284	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 - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 403 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	82 B	DER	15.32	TER	15.83
Environmental	88 B	% DER < TER			3.22
CO_2 Emissions (t/year)	0.99	DFEE	44.07	TFEE	44.41
Compliance Check	See BREL	% DFEE < TFEE			0.75
% DPER < TPER	-4.00	DPER	87.86	TPER	84.48

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)	
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	595.9800	(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) =	5794.2800	(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)

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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	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)

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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)												2928.8558	
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)												2928.8558	
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	660.0223	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	362.8835	548.6071	801.0267	1033.7848	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)												2981.5565	
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)												2981.5565	
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 Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 501 VL - Be Lean	Prop Type Ref	Flat 203 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	81 B	DER	19.55	TER	20.65
Environmental	86 B	% DER < TER			5.33
CO_2 Emissions (t/year)	0.88	DFEE	54.71	TFEE	56.55
Compliance Check	See BREL	% DFEE < TFEE			3.25
% DPER < TPER	-0.06	DPER	110.85	TPER	110.78

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	672.1400	(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 Lean	Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	House - 10-12 Museum Street
Property	Museum Street, London, WC1A		

SAP Rating	73 C	DER	26.55	TER	12.69
Environmental	73 C	% DER < TER			-109.22
CO_2 Emissions (t/year)	3.25	DFEE	91.99	TFEE	50.57
Compliance Check	See BREL	% DFEE < TFEE			-81.90
% DPER < TPER	-121.05	DPER	147.46	TPER	66.71

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)	
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 Lean	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	22.54	TER	14.01
Environmental	79 C	% DER < TER			-60.89
CO_2 Emissions (t/year)	1.87	DFEE	70.87	TFEE	39.83
Compliance Check	See BREL	% DFEE < TFEE			-77.92
% DPER < TPER	-65.86	DPER	126.57	TPER	76.31

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 Lean	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	19.80	TER	12.31
Environmental	80 C	% DER < TER			-60.84
CO_2 Emissions (t/year)	2.15	DFEE	64.45	TFEE	37.19
Compliance Check	See BREL	% DFEE < TFEE			-73.32
% DPER < TPER	-66.24	DPER	111.63	TPER	67.15

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	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 Lean	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	27.98	TER	17.31
Environmental	80 C	% DER < TER			-61.64
CO_2 Emissions (t/year)	1.22	DFEE	79.29	TFEE	44.43
Compliance Check	See BREL	% DFEE < TFEE			-78.45
% DPER < TPER	-69.91	DPER	156.84	TPER	92.31

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)

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 = 1.60)			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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(64)
										Total per year (kWh/year) = Sum(64)m =		2270.5474	(64)
12Total per year (kWh/year)												2271	(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	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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	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)	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains	381.0401	389.0132	372.7042	358.1806	338.9825	322.2567	309.2172	310.8587	321.2717	336.7237	358.3718	373.1134	(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)

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	458.3789	527.0849	580.9155	652.5388	704.8076	702.1034	668.4364	613.6968	558.5612	494.2865	452.0998	438.6239	(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	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	0.9916	0.9856	0.9736	0.9382	0.8585	0.7105	0.5620	0.6195	0.8342	0.9560	0.9858	0.9929	(86)
MIT	18.8843	19.1172	19.4902	20.0373	20.5114	20.8399	20.9497	20.9284	20.6849	20.0828	19.4172	18.8775	(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	0.9887	0.9804	0.9635	0.9129	0.7977	0.5905	0.3919	0.4493	0.7400	0.9326	0.9797	0.9903	(89)
MIT 2	17.5946	17.8292	18.2008	18.7497	19.1802	19.4542	19.5101	19.5098	19.3486	18.8085	18.1503	17.6051	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	18.2655	18.4992	18.8715	19.4195	19.8727	20.1750	20.2590	20.2477	20.0437	19.4714	18.8093	18.2670	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2655	18.4992	18.8715	19.4195	19.8727	20.1750	20.2590	20.2477	20.0437	19.4714	18.8093	18.2670	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9761	0.9585	0.9116	0.8155	0.6480	0.4809	0.5380	0.7790	0.9323	0.9760	0.9875	(94)
Useful gains	451.7258	514.4899	556.8292	594.8539	574.7531	454.9907	321.4840	330.1719	435.1267	460.8150	441.2609	433.1591	(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	1365.6213	1323.3544	1198.0153	993.7193	768.1529	510.7728	335.2285	350.6981	550.1892	833.8228	1111.6718	1348.8513	(97)
Space heating kWh	679.9383	543.5570	477.0425	287.1831	143.8895	0.0000	0.0000	0.0000	0.0000	277.5178	482.6958	681.2751	(98a)
Space heating requirement - total per year (kWh/year)												3573.0990	
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	679.9383	543.5570	477.0425	287.1831	143.8895	0.0000	0.0000	0.0000	0.0000	277.5178	482.6958	681.2751	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3573.0990	
Space heating per m2											(98c) / (4) =	67.4170	(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	0.7489	0.8234	0.7829	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	645.0020	558.2303	542.3073	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	785.9951	748.6246	685.7526	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	101.5150	141.6534	106.7233	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	25.3788	35.4133	26.6808	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												87.4729	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	679.9383	543.5570	477.0425	287.1831	143.8895	0.0000	0.0000	0.0000	0.0000	277.5178	482.6958	681.2751 (98)
Space heating efficiency (main heating system 1)												
	84.4000	84.4000	84.4000	84.4000	84.4000	0.0000	0.0000	0.0000	0.0000	84.4000	84.4000	84.4000 (210)
Space heating fuel (main heating system)												
	805.6141	644.0248	565.2162	340.2644	170.4852	0.0000	0.0000	0.0000	0.0000	328.8126	571.9145	807.1979 (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												
	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306 (64)
Efficiency of water heater												89.4000 (216)
(217)m	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000 (217)
Fuel for water heating, kWh/month												
	252.3072	223.3399	237.5630	209.3106	201.6191	179.8341	176.6276	185.1660	188.6953	211.3975	224.3151	249.5868 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	5.9020	8.2357	6.2048	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	23.5111	21.2359	23.5111	22.7527	23.5111	22.7527	23.5111	23.5111	22.7527	23.5111	22.7527	23.5111 (231)
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 (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	4233.5297 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.4000
Water heating fuel used	2539.7622 (219)
Space cooling fuel	20.3425 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)	
mechanical ventilation fans (SFP = 1.0540)	190.8246 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	276.8246 (231)
Electricity for lighting (calculated in Appendix L)	137.6532 (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	7208.1122 (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	4233.5297	0.2100	889.0412	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2539.7622	0.2100	533.3501	(264)
Space and water heating			1422.3913	(265)
Space cooling	20.3425	0.1139	2.3173	(266)
Pumps, fans and electric keep-hot	276.8246	0.1387	38.3990	(267)
Energy for lighting	137.6532	0.1443	19.8676	(268)
Total CO2, kg/year			1482.9752	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			27.9800	(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	4233.5297	1.1300	4783.8885	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2539.7622	1.1300	2869.9313	(278)
Space and water heating			7653.8198	(279)
Space cooling	20.3425	1.4199	28.8846	(280)
Pumps, fans and electric keep-hot	276.8246	1.5128	418.7802	(281)

Energy for lighting	137.6532	1.5338	211.1371 (282)
Total Primary energy kWh/year			8312.6216 (286)
Dwelling Primary energy Rate (DPER)			156.8400 (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	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)

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) =	0.1348	(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)

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

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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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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													
	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
										Total per year (kWh/year) = Sum(64)m =		2040.9999	(64)
12Total per year (kWh/year)												2041	(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													
	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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													
	78.3035	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)													
	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains													
	381.1549	389.1403	372.8190	358.2992	339.0973	322.3754	309.3320	310.9735	321.3903	336.8385	358.4905	373.2282	(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	7.8700	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	445.9740	504.8626	547.3332	605.0278	645.7372	640.7718	610.4367	564.8131	520.2798	468.8984	437.0459	428.1335	(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	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													
	0.9917	0.9843	0.9686	0.9182	0.8039	0.6212	0.4651	0.5199	0.7645	0.9409	0.9840	0.9931	(86)
MIT	19.6567	19.8486	20.1302	20.5125	20.8105	20.9577	20.9913	20.9856	20.8891	20.5112	20.0236	19.6249	(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													
	0.9890	0.9793	0.9582	0.8911	0.7447	0.5271	0.3516	0.4012	0.6777	0.9153	0.9779	0.9909	(89)
MIT 2	18.3341	18.5783	18.9328	19.4027	19.7306	19.8685	19.8886	19.8880	19.8168	19.4134	18.8091	18.2992	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.0221	19.2391	19.5557	19.9800	20.2923	20.4351	20.4622	20.4589	20.3746	19.9844	19.4409	18.9888	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0221	19.2391	19.5557	19.9800	20.2923	20.4351	20.4622	20.4589	20.3746	19.9844	19.4409	18.9888	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9757	0.9546	0.8938	0.7680	0.5747	0.4108	0.4631	0.7183	0.9181	0.9749	0.9885	(94)
Useful gains	439.8778	492.6005	522.4658	540.7861	495.9278	368.2778	250.7552	261.5636	373.7395	430.4882	426.0600	423.2012	(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													
	987.7243	960.0580	872.3678	733.3460	567.6787	382.2962	253.0391	265.5128	412.4229	620.0109	818.2930	984.3099	(97)
Space heating kWh													
	407.5978	314.1314	260.3271	138.6432	53.3827	0.0000	0.0000	0.0000	0.0000	141.0049	282.4077	417.4649	(98a)
Space heating requirement - total per year (kWh/year)												2014.9597	
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													
	407.5978	314.1314	260.3271	138.6432	53.3827	0.0000	0.0000	0.0000	0.0000	141.0049	282.4077	417.4649	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2014.9597	
Space heating per m2											(98c) / (4) =	38.0181	(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 %)	92.4000 (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													
	407.5978	314.1314	260.3271	138.6432	53.3827	0.0000	0.0000	0.0000	0.0000	141.0049	282.4077	417.4649	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	441.1232	339.9691	281.7393	150.0467	57.7734	0.0000	0.0000	0.0000	0.0000	152.6027	305.6361	451.8018	(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													
	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8643	85.5868	85.0622	83.9706	82.2671	80.3000	80.3000	80.3000	80.3000	83.9765	85.3460	85.9304	(217)
Fuel for water heating, kWh/month													
	233.9245	207.7617	222.7807	200.2830	197.6386	181.3989	179.0080	187.3958	190.6127	203.1059	210.5088	231.4470	(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												2180.6923	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	

Water heating fuel used	2445.8657 (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	4188.9511 (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	2180.6923	0.2100	457.9454	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2445.8657	0.2100	513.6318	(264)
Space and water heating			971.5772	(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			917.4984	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.3100	(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	2180.6923	1.1300	2464.1823	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2445.8657	1.1300	2763.8282	(278)
Space and water heating			5228.0105	(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			4892.6519	(286)
Target Primary Energy Rate (TPER)			92.3100	(287)

Full SAP Calculation Printout

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

SAP Rating	79 C	DER	21.75	TER	13.83
Environmental	85 B	% DER < TER			-57.27
CO_2 Emissions (t/year)	0.93	DFEE	55.03	TFEE	28.62
Compliance Check	See BREL	% DFEE < TFEE			-92.29
% DPER < TPER	-67.36	DPER	123.21	TPER	73.62

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)

	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 = 1.50)			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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(64)
										Total per year (kWh/year) = Sum(64)m =		2252.8297	(64)
12Total per year (kWh/year)												2253	(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	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	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)	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains	375.9843	383.8089	367.7433	353.3547	334.3213	317.7789	304.9301	306.5688	316.8360	332.2852	353.6331	368.1820	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	449.5066	519.8655	582.6441	667.8035	730.5034	730.4383	694.7285	632.4334	565.7439	490.4063	443.6664	429.8266	(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	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	0.9913	0.9829	0.9631	0.8970	0.7609	0.5628	0.4176	0.4730	0.7332	0.9345	0.9831	0.9927	(86)
MIT	19.4872	19.7146	20.0534	20.5198	20.8295	20.9685	20.9935	20.9891	20.8966	20.4831	19.9348	19.4867	(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	0.9884	0.9773	0.9508	0.8646	0.6959	0.4711	0.3114	0.3604	0.6419	0.9062	0.9766	0.9903	(89)
MIT 2	18.4277	18.6569	18.9922	19.4546	19.7175	19.8422	19.8534	19.8590	19.7912	19.4383	18.9020	18.4476	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	18.9238	19.1522	19.4892	19.9534	20.2382	20.3696	20.3873	20.3882	20.3088	19.9275	19.3856	18.9342	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9238	19.1522	19.4892	19.9534	20.2382	20.3696	20.3873	20.3882	20.3088	19.9275	19.3856	18.9342	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9857	0.9736	0.9472	0.8689	0.7204	0.5133	0.3613	0.4133	0.6812	0.9093	0.9736	0.9880	(94)
Useful gains	443.0918	506.1567	551.8870	580.2735	526.2731	374.9428	250.9932	261.3834	385.3908	445.9059	431.9426	424.6744	(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	1061.6033	1028.1328	931.1048	767.1698	588.7133	384.6771	252.5102	264.0875	419.6152	643.1370	858.2889	1042.7713	(97)
Space heating kWh	460.1725	350.7679	282.1380	134.5653	46.4555	0.0000	0.0000	0.0000	0.0000	146.7399	306.9694	459.8641	(98a)
Space heating requirement - total per year (kWh/year)												2187.6727	
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	460.1725	350.7679	282.1380	134.5653	46.4555	0.0000	0.0000	0.0000	0.0000	146.7399	306.9694	459.8641	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2187.6727	
Space heating per m2											(98c) / (4) =	42.0706	(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	0.9119	0.9516	0.9300	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	571.5332	469.4997	468.0385	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	818.6995	778.8287	706.7647	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	177.9597	230.1408	177.6123	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	44.4899	57.5352	44.4031	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												146.4282	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.1725	350.7679	282.1380	134.5653	46.4555	0.0000	0.0000	0.0000	0.0000	146.7399	306.9694	459.8641	(98)

Space heating efficiency (main heating system 1)
84.4000 84.4000 84.4000 84.4000 84.4000 0.0000 0.0000 0.0000 0.0000 84.4000 84.4000 84.4000 (210)
Space heating fuel (main heating system)
545.2281 415.6018 334.2867 159.4376 55.0421 0.0000 0.0000 0.0000 0.0000 173.8624 363.7078 544.8627 (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
223.9644 198.2597 210.9038 185.7371 178.5977 159.3002 156.4598 164.0232 167.1496 187.7259 199.1535 221.5547 (64)
Efficiency of water heater
89.4000 (216)
(217)m 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 (217)
Fuel for water heating, kWh/month
250.5195 221.7670 235.9103 207.7597 199.7737 178.1882 175.0110 183.4711 186.9682 209.9842 222.7668 247.8241 (219)
Space cooling fuel requirement
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 10.3465 13.3803 10.3263 0.0000 0.0000 0.0000 0.0000 (221)
Pumps and Fa 22.8646 20.6519 22.8646 22.1270 22.8646 22.1270 22.8646 22.8646 22.1270 22.8646 22.1270 22.8646 (231)
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 (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 2592.0292 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.4000
Water heating fuel used 2519.9437 (219)
Space cooling fuel 34.0531 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 183.2122 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 269.2122 (231)
Electricity for lighting (calculated in Appendix L) 113.9905 (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 5529.2287 (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	2592.0292	0.2100	544.3261	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2519.9437	0.2100	529.1882	(264)
Space and water heating			1073.5143	(265)
Space cooling	34.0531	0.1140	3.8833	(266)
Pumps, fans and electric keep-hot	269.2122	0.1387	37.3430	(267)
Energy for lighting	113.9905	0.1443	16.4523	(268)
Total CO2, kg/year			1131.1931	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			21.7500	(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	2592.0292	1.1300	2928.9930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2519.9437	1.1300	2847.5364	(278)
Space and water heating			5776.5295	(279)
Space cooling	34.0531	1.4203	48.3666	(280)
Pumps, fans and electric keep-hot	269.2122	1.5128	407.2642	(281)
Energy for lighting	113.9905	1.5338	174.8424	(282)

Total Primary energy kWh/year 6407.0026 (286)
Dwelling Primary energy Rate (DPER) 123.2100 (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	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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1109	383.9490	367.8698	353.4854	334.4478	317.9096	305.0567	306.6953	316.9668	332.4117	353.7638	368.3085	(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	438.5116	499.4263	550.2699	620.3845	670.7254	668.1750	635.9168	583.2857	528.2329	466.6173	430.1783	420.6281	(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												

	0.9890	0.9764	0.9450	0.8441	0.6671	0.4718	0.3427	0.3894	0.6310	0.8959	0.9760	0.9911 (86)
MIT	20.1060	20.2902	20.5366	20.8199	20.9598	20.9954	20.9994	20.9988	20.9779	20.7794	20.4023	20.0765 (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												
	0.9858	0.9697	0.9300	0.8087	0.6124	0.4086	0.2746	0.3157	0.5583	0.8622	0.9680	0.9885 (89)
MIT 2	19.0719	19.3046	19.6089	19.9425	20.0829	20.1197	20.1219	20.1233	20.1053	19.9088	19.4557	19.0411 (90)
Living area fraction										fLA = Living area / (4) =		0.4683 (91)
MIT	19.5562	19.7661	20.0433	20.3533	20.4935	20.5297	20.5328	20.5333	20.5140	20.3164	19.8990	19.5260 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5562	19.7661	20.0433	20.3533	20.4935	20.5297	20.5328	20.5333	20.5140	20.3164	19.8990	19.5260 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9667	0.9289	0.8190	0.6364	0.4381	0.3065	0.3502	0.5916	0.8707	0.9657	0.9863	(94)
Useful gains	431.1954	482.7806	511.1291	508.0799	426.8458	292.7324	194.9138	204.2875	312.5084	406.2902	415.4184	414.8560	(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	780.3706	758.4010	689.1130	575.6076	440.9051	294.0864	195.0477	204.5728	319.4465	487.1809	644.7681	775.8608	(97)
Space heating kWh	259.7863	185.2169	132.4201	48.6200	10.4601	0.0000	0.0000	0.0000	0.0000	60.1827	165.1318	268.5876	(98a)
Space heating requirement - total per year (kWh/year)												1130.4057	
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	259.7863	185.2169	132.4201	48.6200	10.4601	0.0000	0.0000	0.0000	0.0000	60.1827	165.1318	268.5876	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1130.4057	
Space heating per m2											(98c) / (4) =	21.7386	(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 %)	92.4000	(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	259.7863	185.2169	132.4201	48.6200	10.4601	0.0000	0.0000	0.0000	0.0000	60.1827	165.1318	268.5876	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	281.1540	200.4512	143.3118	52.6190	11.3205	0.0000	0.0000	0.0000	0.0000	65.1328	178.7141	290.6792	(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	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	84.9483	84.4836	83.6415	82.0910	80.7764	80.3000	80.3000	80.3000	80.3000	82.3887	84.2153	85.0404	(217)
Fuel for water heating, kWh/month	234.8317	209.0470	225.0486	203.3909	199.4435	179.7386	177.3695	185.6805	188.8679	205.6915	211.9185	232.2769	(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	1223.3827	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2453.3051	(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	3249.2653 (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	1223.3827	0.2100	256.9104	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2453.3051	0.2100	515.1941	(264)
Space and water heating			772.1045	(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			719.3137	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8300	(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	1223.3827	1.1300	1382.4225	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2453.3051	1.1300	2772.2348	(278)
Space and water heating			4154.6573	(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			3828.1074	(286)
Target Primary Energy Rate (TPER)			73.6200	(287)

Full SAP Calculation Printout

Property Reference	2.F Flat - 39-41 OS Lean	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	21.89	TER	14.21
Environmental	85 B	% DER < TER			-54.05
CO_2 Emissions (t/year)	0.96	DFEE	55.54	TFEE	30.35
Compliance Check	See BREL	% DFEE < TFEE			-82.98
% DPER < TPER	-63.19	DPER	123.47	TPER	75.66

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 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)

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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)			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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(64)
										Total per year (kWh/year) = Sum(64)m =		2270.5474	(64)
12Total per year (kWh/year)												2271	(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	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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)	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains	381.3884	389.3988	373.0525	358.5405	339.3309	322.6167	309.5655	311.2070	321.6316	337.0720	358.7317	373.4617	(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	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	430.7405	479.7988	516.0372	572.0798	614.6320	612.5940	582.1411	534.6419	488.2946	441.9473	418.9380	415.0214	(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	0.9930	0.9877	0.9761	0.9345	0.8317	0.6443	0.4862	0.5441	0.7970	0.9533	0.9868	0.9940	(86)
MIT	19.5182	19.7032	19.9932	20.4297	20.7671	20.9508	20.9895	20.9828	20.8634	20.4423	19.9386	19.5216	(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	0.9907	0.9836	0.9678	0.9111	0.7754	0.5488	0.3684	0.4217	0.7129	0.9318	0.9817	0.9921	(89)
MIT 2	18.4914	18.6791	18.9691	19.4107	19.7107	19.8700	19.8885	19.8928	19.8081	19.4356	18.9371	18.5135	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	19.0256	19.2118	19.5018	19.9408	20.2602	20.4322	20.4612	20.4598	20.3570	19.9592	19.4580	19.0379	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0256	19.2118	19.5018	19.9408	20.2602	20.4322	20.4612	20.4598	20.3570	19.9592	19.4580	19.0379	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9809	0.9650	0.9132	0.7969	0.5971	0.4299	0.4856	0.7519	0.9340	0.9795	0.9902	(94)
Useful gains	425.8310	470.6501	497.9570	522.4112	489.7867	365.7760	250.2661	259.6134	367.1301	412.7943	410.3361	410.9738	(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	1045.4456	1010.0601	912.1417	751.3670	578.9587	382.2004	253.0358	264.3433	415.2995	633.0006	846.2062	1028.4843	(97)
Space heating kWh	460.9933	362.4835	308.1534	164.8482	66.3439	0.0000	0.0000	0.0000	0.0000	163.8335	313.8265	459.4278	(98a)
Space heating requirement - total per year (kWh/year)												2299.9100	
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	460.9933	362.4835	308.1534	164.8482	66.3439	0.0000	0.0000	0.0000	0.0000	163.8335	313.8265	459.4278	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2299.9100	
Space heating per m2											(98c) / (4) =	43.3945	(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	0.8640	0.9209	0.8914	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	532.2480	446.5724	441.1142	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	679.9169	646.2333	591.4884	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	106.3217	148.5478	111.8784	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	26.5804	37.1369	27.9696	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												91.6870	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												

	460.9933	362.4835	308.1534	164.8482	66.3439	0.0000	0.0000	0.0000	0.0000	163.8335	313.8265	459.4278 (98)
Space heating efficiency (main heating system 1)												
	84.4000	84.4000	84.4000	84.4000	84.4000	0.0000	0.0000	0.0000	0.0000	84.4000	84.4000	84.4000 (210)
Space heating fuel (main heating system)												
	546.2005	429.4828	365.1106	195.3178	78.6065	0.0000	0.0000	0.0000	0.0000	194.1155	371.8323	544.3457 (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												
	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306 (64)
Efficiency of water heater												89.4000 (216)
(217)m	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000	89.4000 (217)
Fuel for water heating, kWh/month												
	252.3072	223.3399	237.5630	209.3106	201.6191	179.8341	176.6276	185.1660	188.6953	211.3975	224.3151	249.5868 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	6.1815	8.6365	6.5046	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	21.6589	19.5629	21.6589	20.9602	21.6589	20.9602	21.6589	21.6589	20.9602	21.6589	20.9602	21.6589 (231)
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 (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	2725.0118 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.4000
Water heating fuel used	2539.7622 (219)
Space cooling fuel	21.3226 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)	
mechanical ventilation fans (SFP = 1.0540)	169.0161 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	255.0161 (231)
Electricity for lighting (calculated in Appendix L)	116.4452 (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	5657.5579 (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	2725.0118	0.2100	572.2525	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2539.7622	0.2100	533.3501	(264)
Space and water heating			1105.6025	(265)
Space cooling	21.3226	0.1139	2.4289	(266)
Pumps, fans and electric keep-hot	255.0161	0.1387	35.3739	(267)
Energy for lighting	116.4452	0.1443	16.8066	(268)
Total CO2, kg/year			1160.2120	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			21.8900	(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	2725.0118	1.1300	3079.2634	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2539.7622	1.1300	2869.9313	(278)
Space and water heating			5949.1947	(279)
Space cooling	21.3226	1.4199	30.2759	(280)
Pumps, fans and electric keep-hot	255.0161	1.5128	385.7883	(281)

Energy for lighting	116.4452	1.5338	178.6076 (282)
Total Primary energy kWh/year			6543.8665 (286)
Dwelling Primary energy Rate (DPER)			123.4700 (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	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	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)

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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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													
	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
										Total per year (kWh/year) = Sum(64)m =		2040.9999	(64)
12Total per year (kWh/year)												2041	(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													
	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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													
	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)													
	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains													
	381.3884	389.3988	373.0525	358.5405	339.3309	322.6167	309.5655	311.2070	321.6316	337.0720	358.7317	373.4617	(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	429.9694	478.3863	513.8031	568.7432	610.3304	608.0631	577.8821	531.1508	485.6904	440.3087	417.9973	414.3720	(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													
	0.9909	0.9822	0.9615	0.8875	0.7307	0.5274	0.3852	0.4364	0.6893	0.9208	0.9808	0.9925	(86)
MIT	20.0693	20.2301	20.4581	20.7558	20.9358	20.9918	20.9989	20.9978	20.9652	20.7331	20.3610	20.0439	(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													
	0.9882	0.9769	0.9501	0.8576	0.6757	0.4577	0.3087	0.3541	0.6141	0.8923	0.9741	0.9902	(89)
MIT 2	19.0244	19.2287	19.5138	19.8730	20.0608	20.1150	20.1190	20.1202	20.0944	19.8571	19.4031	18.9984	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.5679	19.7496	20.0050	20.3322	20.5159	20.5711	20.5767	20.5767	20.5474	20.3128	19.9014	19.5423	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5679	19.7496	20.0050	20.3322	20.5159	20.5711	20.5767	20.5767	20.5474	20.3128	19.9014	19.5423	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9861	0.9745	0.9487	0.8657	0.7015	0.4937	0.3485	0.3969	0.6519	0.8996	0.9722	0.9884	(94)
Useful gains	424.0091	466.1706	487.4598	492.3688	428.1633	300.2187	201.4081	210.8361	316.6105	396.0876	406.3943	409.5719	(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													
	797.6138	773.7842	701.9603	587.2189	451.8246	302.8382	201.6897	211.4198	328.3198	497.7879	659.0503	793.5776	(97)
Space heating kWh													
	277.9619	206.7163	159.5883	68.2921	17.6040	0.0000	0.0000	0.0000	0.0000	75.6650	181.9123	285.7003	(98a)
Space heating requirement - total per year (kWh/year)												1273.4402	
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													
	277.9619	206.7163	159.5883	68.2921	17.6040	0.0000	0.0000	0.0000	0.0000	75.6650	181.9123	285.7003	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1273.4402	
Space heating per m2											(98c) / (4) =	24.0272	(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 %)												92.4000	(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													
	277.9619	206.7163	159.5883	68.2921	17.6040	0.0000	0.0000	0.0000	0.0000	75.6650	181.9123	285.7003	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	300.8246	223.7190	172.7147	73.9092	19.0519	0.0000	0.0000	0.0000	0.0000	81.8885	196.8748	309.1994	(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													
	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.0778	84.7050	84.0155	82.6079	81.0661	80.3000	80.3000	80.3000	80.3000	82.7602	84.4082	85.1569	(217)
Fuel for water heating, kWh/month													
	236.0872	209.9246	225.5560	203.5869	200.5665	181.3989	179.0080	187.3958	190.6127	206.0909	212.8479	233.5492	(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												1378.1821	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2466.6246	(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	3407.5913 (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	1378.1821	0.2100	289.4182	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2466.6246	0.2100	517.9912	(264)
Space and water heating			807.4094	(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			753.3871	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.2100	(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	1378.1821	1.1300	1557.3457	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2466.6246	1.1300	2787.2858	(278)
Space and water heating			4344.6315	(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			4009.8573	(286)
Target Primary Energy Rate (TPER)			75.6600	(287)

Full SAP Calculation Printout

Property Reference	3.F Flat - 10-12 MS Lean	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	25.03	TER	14.85
Environmental	83 B	% DER < TER			-68.55
CO_2 Emissions (t/year)	1.08	DFEE	67.46	TFEE	33.20
Compliance Check	See BREL	% DFEE < TFEE			-103.23
% DPER < TPER	-77.48	DPER	140.37	TPER	79.09

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)

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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)			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	

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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	
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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(64)
										Total per year (kWh/year) = Sum(64)m =		2252.8297	(64)
12Total per year (kWh/year)												2253	(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	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	76.8832	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	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)	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains	375.9862	383.8109	367.7451	353.3566	334.3231	317.7808	304.9320	306.5706	316.8379	332.2870	353.6350	368.1838	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	441.9070	505.2398	558.1707	630.0020	681.3373	678.6257	646.0250	592.6673	536.7275	473.0387	434.2576	423.5210	(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	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	0.9921	0.9859	0.9726	0.9307	0.8361	0.6689	0.5154	0.5736	0.8098	0.9529	0.9860	0.9933	(86)
MIT	19.1668	19.3865	19.7358	20.2412	20.6519	20.9039	20.9742	20.9609	20.7801	20.2529	19.6485	19.1597	(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	0.9894	0.9811	0.9627	0.9045	0.7747	0.5585	0.3705	0.4254	0.7174	0.9295	0.9802	0.9910	(89)
MIT 2	17.9896	18.2109	18.5584	19.0632	19.4292	19.6377	19.6719	19.6738	19.5548	19.0894	18.4932	17.9991	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	18.5409	18.7614	19.1097	19.6148	20.0018	20.2306	20.2817	20.2765	20.1286	19.6342	19.0342	18.5426	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5409	18.7614	19.1097	19.6148	20.0018	20.2306	20.2817	20.2765	20.1286	19.6342	19.0342	18.5426	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9865	0.9771	0.9580	0.9039	0.7927	0.6076	0.4388	0.4952	0.7535	0.9291	0.9768	0.9885	(94)
Useful gains	435.9298	493.6603	534.7185	569.4389	540.0943	412.2994	283.4785	293.4802	404.4075	439.5232	424.1646	418.6321	(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	1196.4802	1158.9301	1049.1244	869.5573	670.3343	443.1332	289.7555	303.5014	479.3850	729.4740	973.3984	1181.5651	(97)
Space heating kWh	565.8495	447.0613	382.7181	216.0853	96.8986	0.0000	0.0000	0.0000	0.0000	215.7234	395.4483	567.6221	(98a)
Space heating requirement - total per year (kWh/year)												2887.4065	
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	565.8495	447.0613	382.7181	216.0853	96.8986	0.0000	0.0000	0.0000	0.0000	215.7234	395.4483	567.6221	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2887.4065	
Space heating per m2											(98c) / (4) =	55.5270	(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	0.8120	0.8780	0.8424	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	600.7338	511.3390	501.2265	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	758.1372	721.9005	660.2829	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	113.3305	156.6578	118.3380	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	28.3326	39.1644	29.5845	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												97.0816	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	565.8495	447.0613	382.7181	216.0853	96.8986	0.0000	0.0000	0.0000	0.0000	215.7234	395.4483	567.6221	(98)

Space heating efficiency (main heating system 1)
84.4000 84.4000 84.4000 84.4000 84.4000 0.0000 0.0000 0.0000 0.0000 84.4000 84.4000 84.4000 (210)
Space heating fuel (main heating system)
670.4378 529.6935 453.4574 256.0252 114.8087 0.0000 0.0000 0.0000 0.0000 255.5964 468.5407 672.5381 (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
223.9644 198.2597 210.9038 185.7371 178.5977 159.3002 156.4598 164.0232 167.1496 187.7259 199.1535 221.5547 (64)
Efficiency of water heater 89.4000 (216)
(217)m 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 (217)
Fuel for water heating, kWh/month
250.5195 221.7670 235.9103 207.7597 199.7737 178.1882 175.0110 183.4711 186.9682 209.9842 222.7668 247.8241 (219)
Space cooling fuel requirement
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 6.5890 9.1080 6.8801 0.0000 0.0000 0.0000 0.0000 (221)
Pumps and Fa 21.2745 19.2157 21.2745 20.5882 21.2745 20.5882 21.2745 21.2745 20.5882 21.2745 20.5882 21.2745 (231)
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 (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 3421.0977 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.4000
Water heating fuel used 2519.9437 (219)
Space cooling fuel 22.5771 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 164.4898 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 250.4898 (231)
Electricity for lighting (calculated in Appendix L) 113.9932 (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 6328.1015 (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	3421.0977	0.2100	718.4305	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2519.9437	0.2100	529.1882	(264)
Space and water heating			1247.6187	(265)
Space cooling	22.5771	0.1139	2.5722	(266)
Pumps, fans and electric keep-hot	250.4898	0.1387	34.7460	(267)
Energy for lighting	113.9932	0.1443	16.4527	(268)
Total CO2, kg/year			1301.3897	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			25.0300	(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	3421.0977	1.1300	3865.8404	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2519.9437	1.1300	2847.5364	(278)
Space and water heating			6713.3769	(279)
Space cooling	22.5771	1.4200	32.0586	(280)
Pumps, fans and electric keep-hot	250.4898	1.5128	378.9409	(281)
Energy for lighting	113.9932	1.5338	174.8466	(282)

Total Primary energy kWh/year 7299.2230 (286)
Dwelling Primary energy Rate (DPER) 140.3700 (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	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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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													
	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	0.0000	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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1109	383.9490	367.8698	353.4854	334.4478	317.9096	305.0567	306.6953	316.9668	332.4117	353.7638	368.3085	(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	440.3827	502.3386	553.5246	623.1933	672.7546	669.6981	637.5897	585.6154	531.3452	469.6392	432.3694	422.2618	(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												
	0.9901	0.9793	0.9533	0.8690	0.7079	0.5113	0.3732	0.4230	0.6716	0.9126	0.9792	0.9919 (86)
MIT	19.9645	20.1555	20.4201	20.7427	20.9303	20.9900	20.9985	20.9971	20.9604	20.7040	20.2845	19.9330 (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												
	0.9870	0.9732	0.9396	0.8352	0.6495	0.4384	0.2931	0.3368	0.5923	0.8812	0.9719	0.9894 (89)
MIT 2	18.8373	19.0791	19.4081	19.7927	19.9857	20.0422	20.0470	20.0481	20.0200	19.7612	19.2516	18.8035 (90)
Living area fraction										fLA = Living area / (4) =		0.4683 (91)
MIT	19.3651	19.5831	19.8820	20.2376	20.4280	20.4860	20.4926	20.4925	20.4604	20.2026	19.7353	19.3324 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3651	19.5831	19.8820	20.2376	20.4280	20.4860	20.4926	20.4925	20.4604	20.2026	19.7353	19.3324 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9844	0.9697	0.9372	0.8428	0.6740	0.4723	0.3306	0.3772	0.6280	0.8872	0.9691	0.9871	(94)
Useful gains	433.5082	487.1268	518.7764	525.2404	453.4105	316.3027	210.8160	220.9125	333.6762	416.6848	418.9898	416.8099	(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													
	840.0538	816.8134	742.6971	622.3369	478.1011	319.3045	211.1631	221.6069	346.3341	526.0106	695.0407	836.0455	(97)
Space heating kWh													
	302.4699	221.5494	166.5970	69.9095	18.3698	0.0000	0.0000	0.0000	0.0000	81.3384	198.7567	311.9113	(98a)
Space heating requirement - total per year (kWh/year)												1370.9019	
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													
	302.4699	221.5494	166.5970	69.9095	18.3698	0.0000	0.0000	0.0000	0.0000	81.3384	198.7567	311.9113	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1370.9019	
Space heating per m2											(98c) / (4) =	26.3635	(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 %)												92.4000	(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													
	302.4699	221.5494	166.5970	69.9095	18.3698	0.0000	0.0000	0.0000	0.0000	81.3384	198.7567	311.9113	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	327.3484	239.7721	180.2998	75.6596	19.8807	0.0000	0.0000	0.0000	0.0000	88.0286	215.1046	337.5663	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2707	84.8683	84.1207	82.6600	81.1030	80.3000	80.3000	80.3000	80.3000	82.9008	84.6128	85.3555	(217)
Fuel for water heating, kWh/month													
	233.9440	208.0993	223.7665	201.9908	198.6403	179.7386	177.3695	185.6805	188.8679	204.4207	210.9231	231.4193	(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												1483.6601	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2444.8606	(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	3501.0981 (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	1483.6601	0.2100	311.5686	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2444.8606	0.2100	513.4207	(264)
Space and water heating			824.9893	(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			772.1985	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.8500	(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	1483.6601	1.1300	1676.5359	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2444.8606	1.1300	2762.6924	(278)
Space and water heating			4439.2284	(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			4112.6784	(286)
Target Primary Energy Rate (TPER)			79.0900	(287)

Full SAP Calculation Printout

Property Reference	3.F Flat - 39-41 OS Lean	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	24.95	TER	15.39
Environmental	82 B	% DER < TER			-62.12
CO_2 Emissions (t/year)	1.1	DFEE	67.29	TFEE	35.27
Compliance Check	See BREL	% DFEE < TFEE			-90.80
% DPER < TPER	-70.44	DPER	139.80	TPER	82.02

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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(64)
										Total per year (kWh/year) = Sum(64)m =		2270.5474	(64)
12Total per year (kWh/year)												2271	(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	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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	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)	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains	384.0016	392.2920	375.6657	361.2408	341.9440	325.3169	312.1787	313.8202	324.3319	339.6852	361.4320	376.0749	(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	424.8574	466.8346	492.7355	534.7183	564.4764	559.2634	532.2635	494.9140	460.3459	425.9496	411.2226	410.5112	(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	45.2680	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	0.9935	0.9897	0.9822	0.9569	0.8919	0.7486	0.5925	0.6473	0.8598	0.9659	0.9888	0.9944	(86)
MIT	19.2312	19.4092	19.7051	20.1650	20.5751	20.8695	20.9632	20.9472	20.7424	20.2353	19.6861	19.2320	(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	0.9913	0.9861	0.9754	0.9391	0.8443	0.6438	0.4396	0.4959	0.7812	0.9483	0.9842	0.9925	(89)
MIT 2	18.0971	18.2778	18.5747	19.0433	19.4245	19.6785	19.7285	19.7288	19.5862	19.1216	18.5748	18.1146	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	18.6870	18.8663	19.1627	19.6268	20.0230	20.2980	20.3708	20.3626	20.1876	19.7009	19.1529	18.6958	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6870	18.8663	19.1627	19.6268	20.0230	20.2980	20.3708	20.3626	20.1876	19.7009	19.1529	18.6958	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9832	0.9720	0.9378	0.8577	0.6941	0.5197	0.5748	0.8138	0.9482	0.9816	0.9905	(94)
Useful gains	420.2048	458.9887	478.9629	501.4818	484.1440	388.1708	276.5927	284.4896	374.6403	403.8739	403.6734	406.6017	(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	1169.7522	1129.8652	1019.2584	841.6186	649.6347	433.1629	286.6534	299.6216	467.7303	710.3530	950.5661	1155.0191	(97)
Space heating kWh	557.6632	450.8290	401.9798	244.8985	123.1251	0.0000	0.0000	0.0000	0.0000	228.0205	393.7628	556.8226	(98a)
Space heating requirement - total per year (kWh/year)												2957.1015	
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	557.6632	450.8290	401.9798	244.8985	123.1251	0.0000	0.0000	0.0000	0.0000	228.0205	393.7628	556.8226	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2957.1015	
Space heating per m2										(98c) / (4) =		55.7944	(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	0.7434	0.8243	0.7852	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	531.2138	463.6798	451.1978	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	614.6156	585.0849	542.2646	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	60.0493	90.3254	67.7537	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	15.0123	22.5813	16.9384	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												54.5321	(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 %)	84.4000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Space heating requirement
557.6632 450.8290 401.9798 244.8985 123.1251 0.0000 0.0000 0.0000 0.0000 228.0205 393.7628 556.8226 (98)
Space heating efficiency (main heating system 1)
84.4000 84.4000 84.4000 84.4000 84.4000 0.0000 0.0000 0.0000 0.0000 84.4000 84.4000 84.4000 (210)
Space heating fuel (main heating system)
660.7384 534.1576 476.2794 290.1641 145.8828 0.0000 0.0000 0.0000 0.0000 270.1664 466.5436 659.7424 (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
225.5626 199.6659 212.3813 187.1237 180.2475 160.7717 157.9051 165.5384 168.6936 188.9893 200.5377 223.1306 (64)
Efficiency of water heater 89.4000 (216)
(217)m 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 89.4000 (217)
Fuel for water heating, kWh/month
252.3072 223.3399 237.5630 209.3106 201.6191 179.8341 176.6276 185.1660 188.6953 211.3975 224.3151 249.5868 (219)
Space cooling fuel requirement
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 3.4912 5.2515 3.9392 0.0000 0.0000 0.0000 0.0000 (221)
Pumps and Fa 21.1958 19.1446 21.1958 20.5121 21.1958 20.5121 21.1958 21.1958 20.5121 21.1958 20.5121 21.1958 (231)
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 (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 3503.6747 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.4000
Water heating fuel used 2539.7622 (219)
Space cooling fuel 12.6819 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 163.5639 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 249.5639 (231)
Electricity for lighting (calculated in Appendix L) 120.3197 (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 6426.0025 (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	3503.6747	0.2100	735.7717	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2539.7622	0.2100	533.3501	(264)
Space and water heating			1269.1218	(265)
Space cooling	12.6819	0.1138	1.4430	(266)
Pumps, fans and electric keep-hot	249.5639	0.1387	34.6176	(267)
Energy for lighting	120.3197	0.1443	17.3659	(268)
Total CO2, kg/year			1322.5483	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			24.9500	(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	3503.6747	1.1300	3959.1524	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2539.7622	1.1300	2869.9313	(278)
Space and water heating			6829.0837	(279)
Space cooling	12.6819	1.4195	18.0015	(280)

Pumps, fans and electric keep-hot	249.5639	1.5128	377.5403 (281)
Energy for lighting	120.3197	1.5338	184.5504 (282)
Total Primary energy kWh/year			7409.1759 (286)
Dwelling Primary energy Rate (DPER)			139.8000 (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	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

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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:													
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	50.9589	46.0274	50.9589	49.3151	49.4951	46.0217	46.8101	48.2645	48.1919	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	225.5626	199.6659	212.3813	187.1237	180.2475	160.7717	157.9051	165.5384	168.6936	188.9893	200.5377	223.1306	(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													
	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
										Total per year (kWh/year) = Sum(64)m =		2040.9999	(64)
12Total per year (kWh/year)												2041	(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													
	70.7955	62.5917	66.4127	58.1501	55.8489	49.6598	48.6416	51.0597	52.1148	58.6348	62.6103	69.9868	(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													
	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)													
	95.1552	93.1423	89.2643	80.7641	75.0658	68.9719	65.3785	68.6286	72.3817	78.8103	86.9587	94.0683	(72)
Total internal gains													
	384.0016	392.2920	375.6657	361.2408	341.9440	325.3169	312.1787	313.8202	324.3319	339.6852	361.4320	376.0749	(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	0.6300	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	424.2190	465.6699	490.9062	532.0077	560.9993	555.6080	528.8246	492.0844	458.2207	424.6017	410.4446	409.9731	(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	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	0.9922	0.9860	0.9725	0.9237	0.8051	0.6104	0.4516	0.5040	0.7551	0.9412	0.9844	0.9935	(86)
MIT	19.9359	20.0878	20.3134	20.6329	20.8725	20.9777	20.9964	20.9936	20.9325	20.6399	20.2443	19.9121	(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	0.9898	0.9817	0.9637	0.8997	0.7516	0.5287	0.3566	0.4041	0.6769	0.9174	0.9788	0.9914	(89)
MIT 2	18.8087	19.0024	19.2872	19.6817	19.9447	20.0447	20.0559	20.0563	20.0098	19.6990	19.2094	18.7844	(90)
Living area fraction										fLA = Living area / (4) =		0.5202	(91)
MIT	19.3951	19.5671	19.8211	20.1765	20.4274	20.5300	20.5451	20.5439	20.4898	20.1884	19.7477	19.3710	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3951	19.5671	19.8211	20.1765	20.4274	20.5300	20.5451	20.5439	20.4898	20.1884	19.7477	19.3710	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9790	0.9613	0.9034	0.7741	0.5706	0.4062	0.4562	0.7148	0.9215	0.9766	0.9896	(94)
Useful gains	419.0091	455.9135	471.8882	480.6011	434.2935	317.0029	214.7835	224.4644	327.5380	391.2585	400.8257	405.6972	(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	848.2163	822.2302	745.0507	623.8470	481.8295	324.2537	215.7182	226.1813	350.6943	529.3677	701.1775	844.7134	(97)
Space heating kWh	319.3302	246.1648	203.2329	103.1371	35.3668	0.0000	0.0000	0.0000	0.0000	102.7532	216.2533	326.6281	(98a)
Space heating requirement - total per year (kWh/year)												1552.8663	
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	319.3302	246.1648	203.2329	103.1371	35.3668	0.0000	0.0000	0.0000	0.0000	102.7532	216.2533	326.6281	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1552.8663	
Space heating per m2											(98c) / (4) =	29.2994	(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 %)	92.4000	(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	319.3302	246.1648	203.2329	103.1371	35.3668	0.0000	0.0000	0.0000	0.0000	102.7532	216.2533	326.6281	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	345.5954	266.4121	219.9490	111.6202	38.2758	0.0000	0.0000	0.0000	0.0000	111.2048	234.0403	353.4936	(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	200.8577	177.8167	189.5021	168.1788	162.5915	145.6633	143.7434	150.4789	153.0620	170.5613	179.6609	198.8832	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.3697	85.0785	84.5317	83.3657	81.7122	80.3000	80.3000	80.3000	80.3000	83.3306	84.7797	85.4371	(217)
Fuel for water heating, kWh/month	235.2800	209.0030	224.1788	201.7363	198.9806	181.3989	179.0080	187.3958	190.6127	204.6802	211.9150	232.7834	(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												1680.5912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000
Water heating fuel used	2456.9726 (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	3704.7305 (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	1680.5912	0.2100	352.9242	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2456.9726	0.2100	515.9643	(264)
Space and water heating			868.8884	(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			815.4986	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900	(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	1680.5912	1.1300	1899.0680	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2456.9726	1.1300	2776.3791	(278)
Space and water heating			4675.4471	(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			4347.2121	(286)
Target Primary Energy Rate (TPER)			82.0200	(287)

Full SAP Calculation Printout

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

SAP Rating	81 B	DER	18.65	TER	19.56
Environmental	87 B	% DER < TER			4.65
CO_2 Emissions (t/year)	0.83	DFEE	55.62	TFEE	56.61
Compliance Check	See BREL	% DFEE < TFEE			1.77
% DPER < TPER	-1.98	DPER	106.99	TPER	104.91

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)

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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)			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

	Length	Psi-value	Total
K1 Element			
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	67.4502	66.4366	64.9595	62.1334	60.0478	57.7219	56.3999	57.8658	59.4727	61.9700	64.8568	67.1918 (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	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)												91.2217 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3886	97.2135	94.5750	90.5875	87.3405	83.8533	82.5313	85.1585	87.9268	91.5855	95.6337	99.1301	(44)
Energy conte	157.4072	138.4308	145.3583	124.0098	117.5771	103.1074	99.8144	105.4441	108.4226	124.2807	136.2478	155.2138	(45)
Energy content (annual)										Total = Sum(45)m =		1515.3138	
Distribution loss (46)m = 0.15 x (45)m	23.6111	20.7646	21.8037	18.6015	17.6366	15.4661	14.9722	15.8166	16.2634	18.6421	20.4372	23.2821	(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	50.6473	44.7449	48.1944	44.6733	44.5078	41.3523	42.0570	43.3959	43.3612	46.6710	47.1618	50.5156	(61)
Total heat required for water heating calculated for each month	208.0545	183.1756	193.5527	168.6831	162.0849	144.4597	141.8714	148.8399	151.7838	170.9516	183.4096	205.7294	(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	208.0545	183.1756	193.5527	168.6831	162.0849	144.4597	141.8714	148.8399	151.7838	170.9516	183.4096	205.7294	(64)
									Total per year (kWh/year) = Sum(64)m =			2062.5963	(64)
12Total per year (kWh/year)												2063	(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	64.9997	57.2144	60.3802	52.4016	50.2213	44.6213	43.7025	45.9091	46.8908	52.9911	57.0928	64.2375	(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	0.0000	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)												
	87.3652	85.1405	81.1562	72.7800	67.5018	61.9740	58.7400	61.7058	65.1261	71.2245	79.2956	86.3407 (72)
Total internal gains												
	360.2133	367.4731	351.6821	337.5849	319.4848	303.7083	291.5025	292.9405	302.6863	317.5057	338.3986	352.6925 (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	8.8000	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)

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	529.4754	671.5797	809.7168	975.4146	1098.0763	1104.8951	1052.1858	944.2941	822.3043	664.9171	544.0111	495.6848 (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	12.1867	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													
	0.8451	0.7821	0.7000	0.5792	0.4519	0.3346	0.2530	0.2887	0.4471	0.6550	0.7965	0.8583	(86)
MIT	17.6826	18.2751	19.0192	19.8413	20.4255	20.7685	20.9018	20.8716	20.5851	19.7595	18.5823	17.5716	(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													
	0.8296	0.7620	0.6738	0.5451	0.4094	0.2826	0.1916	0.2234	0.3895	0.6161	0.7741	0.8440	(89)
MIT 2	16.1021	16.8111	17.6945	18.6508	19.2997	19.6642	19.7859	19.7669	19.4967	18.5958	17.2058	15.9708	(90)
Living area fraction									fLA = Living area / (4) =			0.6934	(91)
MIT	17.1980	17.8262	18.6131	19.4763	20.0804	20.4299	20.5597	20.5329	20.2514	19.4027	18.1603	17.0808	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0480	17.6762	18.4631	19.3263	19.9304	20.2799	20.4097	20.3829	20.1014	19.2527	18.0103	16.9308	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7835	0.7185	0.6396	0.5293	0.4132	0.3028	0.2223	0.2545	0.4032	0.5947	0.7318	0.7983	(94)
Useful gains	414.8432	482.5258	517.9047	516.2891	453.7008	334.5423	233.9019	240.3139	331.5441	395.4200	398.1194	395.7185	(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													
	852.6743	852.6373	796.5727	686.4044	540.5978	368.8062	247.3663	258.0136	391.4859	568.3404	719.9078	843.8612	(97)
Space heating kWh													
	325.7463	248.7149	207.3290	122.4830	64.6514	0.0000	0.0000	0.0000	0.0000	128.6527	231.6876	333.4181	(98a)
Space heating requirement - total per year (kWh/year)												1662.6831	
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													
	325.7463	248.7149	207.3290	122.4830	64.6514	0.0000	0.0000	0.0000	0.0000	128.6527	231.6876	333.4181	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1662.6831	
Space heating per m2										(98c) / (4) =		33.2537	(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	0.8436	0.8792	0.8550	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	514.9076	422.4589	420.9470	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1258.5346	1198.6959	1073.3362	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	535.4114	577.5204	485.3775	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	119.6644	129.0758	108.4819	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												357.2221	(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 %)	89.5000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	325.7463	248.7149	207.3290	122.4830	64.6514	0.0000	0.0000	0.0000	0.0000	128.6527	231.6876	333.4181	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	363.9623	277.8937	231.6525	136.8525	72.2362	0.0000	0.0000	0.0000	0.0000	143.7461	258.8689	372.5342	(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													
	208.0545	183.1756	193.5527	168.6831	162.0849	144.4597	141.8714	148.8399	151.7838	170.9516	183.4096	205.7294	(64)
Efficiency of water heater													
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	232.4631	204.6655	216.2600	188.4727	181.1004	161.4075	158.5156	166.3016	169.5908	191.0074	204.9269	229.8653	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	27.8289	30.0176	25.2283	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	20.1654	18.2139	20.1654	19.5149	20.1654	19.5149	20.1654	20.1654	19.5149	20.1654	19.5149	20.1654	(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	1857.7465 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2304.5768 (219)
Space cooling fuel	83.0749 (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)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	237.4313 (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	4592.9372 (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	1857.7465	0.2100	390.1268	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2304.5768	0.2100	483.9611	(264)
Space and water heating			874.0879	(265)
Space cooling	83.0749	0.1143	9.4970	(266)
Pumps, fans and electric keep-hot	237.4313	0.1387	32.9346	(267)
Energy for lighting	110.1077	0.1443	15.8919	(268)
Total CO2, kg/year			932.4115	(272)

EPC Dwelling Carbon Dioxide Emission Rate (DER) 18.6500 (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	1857.7465	1.1300	2099.2535	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2304.5768	1.1300	2604.1718	(278)
Space and water heating			4703.4254	(279)
Space cooling	83.0749	1.4213	118.0740	(280)
Pumps, fans and electric keep-hot	237.4313	1.5128	359.1860	(281)
Energy for lighting	110.1077	1.5338	168.8869	(282)
Total Primary energy kWh/year			5349.5723	(286)
Dwelling Primary energy Rate (DPER)			106.9900	(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

	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	67.4502	66.4366	64.9595	62.1334	60.0478	57.7219	56.3999	57.8658	59.4727	61.9700	64.8568	67.1918 (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	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)												91.2217 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3886	97.2135	94.5750	90.5875	87.3405	83.8533	82.5313	85.1585	87.9268	91.5855	95.6337	99.1301	(44)
Energy conte	157.4072	138.4308	145.3583	124.0098	117.5771	103.1074	99.8144	105.4441	108.4226	124.2807	136.2478	155.2138	(45)
Energy content (annual)										Total = Sum(45)m =		1515.3138	
Distribution loss (46)m = 0.15 x (45)m	23.6111	20.7646	21.8037	18.6015	17.6366	15.4661	14.9722	15.8166	16.2634	18.6421	20.4372	23.2821	(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	50.6473	44.7449	48.1944	44.6733	44.5078	41.3523	42.0570	43.3959	43.3612	46.6710	47.1618	50.5156	(61)
Total heat required for water heating calculated for each month	208.0545	183.1756	193.5527	168.6831	162.0849	144.4597	141.8714	148.8399	151.7838	170.9516	183.4096	205.7294	(62)
WWHRS	-30.8354	-27.2711	-28.5567	-23.6461	-22.0373	-18.8575	-17.6759	-18.7965	-19.5107	-23.0009	-26.0573	-30.2644	(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	177.2191	155.9045	164.9960	145.0370	140.0476	125.6022	124.1955	130.0434	132.2731	147.9507	157.3523	175.4650	(64)
									Total per year (kWh/year) = Sum(64)m =			1776.0863	(64)
12Total per year (kWh/year)												1776	(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	64.9997	57.2144	60.3802	52.4016	50.2213	44.6213	43.7025	45.9091	46.8908	52.9911	57.0928	64.2375	(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)	87.3652	85.1405	81.1562	72.7800	67.5018	61.9740	58.7400	61.7058	65.1261	71.2245	79.2956	86.3407	(72)
Total internal gains	360.2133	367.4731	351.6821	337.5849	319.4848	303.7083	291.5025	292.9405	302.6863	317.5057	338.3986	352.6925	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	446.1620	521.8816	584.2160	661.3499	714.6631	710.3396	677.5829	623.5557	566.4690	493.8937	442.8033	425.3032	(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	0.9024	0.8721	0.8296	0.7538	0.6517	0.5282	0.4215	0.4618	0.6292	0.7902	0.8744	0.9093	(86)
MIT	17.1033	17.5295	18.1935	19.0786	19.8755	20.4717	20.7542	20.6999	20.2208	19.1918	18.0063	17.0283	(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	0.8897	0.8557	0.8071	0.7197	0.5998	0.4497	0.3147	0.3547	0.5563	0.7533	0.8555	0.8975	(89)
MIT 2	15.2940	15.8120	16.6180	17.6777	18.5980	19.2474	19.5125	19.4749	19.0091	17.8424	16.4107	15.2046	(90)
Living area fraction									fLA = Living area / (4) =			0.6934	(91)
MIT	16.5485	17.0029	17.7104	18.6491	19.4838	20.0964	20.3735	20.3243	19.8493	18.7781	17.5171	16.4692	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.5485	17.0029	17.7104	18.6491	19.4838	20.0964	20.3735	20.3243	19.8493	18.7781	17.5171	16.4692	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8507	0.8148	0.7680	0.6911	0.5936	0.4777	0.3749	0.4114	0.5688	0.7254	0.8170	0.8595	(94)
Useful gains	379.5604	425.2427	448.6819	457.0402	424.1995	339.3508	254.0158	256.5320	322.2166	358.2510	361.7487	365.5495	(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	979.4425	965.8190	892.8016	769.0806	612.9451	429.2133	294.6755	305.9745	450.4171	643.9935	823.2781	973.3031	(97)
Space heating kWh	446.3123	363.2673	330.4251	224.6691	140.4267	0.0000	0.0000	0.0000	0.0000	212.5924	332.3012	452.1687	(98a)
Space heating requirement - total per year (kWh/year)												2502.1628	
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	446.3123	363.2673	330.4251	224.6691	140.4267	0.0000	0.0000	0.0000	0.0000	212.5924	332.3012	452.1687	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2502.1628	
Space heating per m2											(98c) / (4) =	50.0433	(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 %)	92.4000 (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	446.3123	363.2673	330.4251	224.6691	140.4267	0.0000	0.0000	0.0000	0.0000	212.5924	332.3012	452.1687	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	483.0220	393.1464	357.6029	243.1484	151.9769	0.0000	0.0000	0.0000	0.0000	230.0784	359.6333	489.3600	(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	177.2191	155.9045	164.9960	145.0370	140.0476	125.6022	124.1955	130.0434	132.2731	147.9507	157.3523	175.4650	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.2739	86.1300	85.8383	85.3155	84.3872	80.3000	80.3000	80.3000	80.3000	85.1575	85.9422	86.3156	(217)
Fuel for water heating, kWh/month													

	205.4145	181.0107	192.2172	170.0008	165.9582	156.4162	154.6644	161.9469	164.7236	173.7378	183.0909	203.2831 (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	2707.9684 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2112.4645 (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	4536.6892 (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	2707.9684	0.2100	568.6734	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2112.4645	0.2100	443.6175	(264)
Space and water heating			1012.2909	(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			978.0197	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.5600	(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	2707.9684	1.1300	3060.0043	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2112.4645	1.1300	2387.0848	(278)
Space and water heating			5447.0891	(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			5245.6404	(286)
Target Primary Energy Rate (TPER)			104.9100	(287)

Full SAP Calculation Printout

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

SAP Rating	83 B	DER	14.45	TER	15.39
Environmental	89 B	% DER < TER			6.11
CO_2 Emissions (t/year)	0.77	DFEE	39.94	TFEE	40.44
Compliance Check	See BREL	% DFEE < TFEE			1.23
% DPER < TPER	-1.78	DPER	83.73	TPER	82.26

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) =	81.0000 (23c)

Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448	(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	14.5852	14.4047	14.2242	13.3217	13.1412	12.2387	12.2387	12.0582	12.5997	13.1412	13.5022	13.8632	(38)
Heat transfer coeff	56.5332	56.3527	56.1722	55.2696	55.0891	54.1866	54.1866	54.0061	54.5476	55.0891	55.4502	55.8112	(39)
Average = Sum(39)m / 12 =												55.2245	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9422	0.9392	0.9362	0.9212	0.9182	0.9031	0.9031	0.9001	0.9091	0.9182	0.9242	0.9302	(40)
HLP (average)												0.9204	
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:													
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	50.9589	46.0274	50.9589	48.8471	48.6661	45.2158	45.9864	47.4503	47.4124	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(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	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(64)
									Total per year (kWh/year) = Sum(64)m =			2239.6454	(64)
12Total per year (kWh/year)												2240	(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	69.9675	61.8355	65.5870	57.2974	54.9135	48.7902	47.7857	50.1984	51.2718	57.9239	61.8638	69.1701	(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)	94.0424	92.0171	88.1545	79.5798	73.8084	67.7642	64.2280	67.4710	71.2109	77.8547	85.9219	92.9706 (72)
Total internal gains	409.9457	419.0613	401.3300	386.0352	365.2028	347.6439	333.5691	335.0174	346.1875	362.5514	385.6796	401.2430 (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	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	537.9294	648.9250	747.3420	867.5639	952.7512	952.1433	907.5486	826.6604	738.6184	625.0936	541.1344	509.3728 (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	29.4173	29.5115	29.6064	30.0898	30.1884	30.6912	30.6912	30.7938	30.4881	30.1884	29.9919	29.7979	
alpha	2.9612	2.9674	2.9738	3.0060	3.0126	3.0461	3.0461	3.0529	3.0325	3.0126	2.9995	2.9865	
util living area	0.9088	0.8568	0.7796	0.6461	0.4959	0.3534	0.2594	0.2951	0.4749	0.7172	0.8638	0.9191	(86)
MIT	19.3305	19.7102	20.1476	20.5999	20.8525	20.9615	20.9888	20.9834	20.9050	20.5388	19.8799	19.2704	(87)
Th 2	20.1318	20.1343	20.1368	20.1496	20.1521	20.1649	20.1649	20.1674	20.1597	20.1521	20.1470	20.1419	(88)
util rest of house	0.8981	0.8413	0.7575	0.6154	0.4581	0.3101	0.2113	0.2435	0.4251	0.6829	0.8464	0.9094	(89)
MIT 2	18.1933	18.6618	19.1940	19.7329	20.0135	20.1349	20.1583	20.1572	20.0807	19.6804	18.8894	18.1256	(90)
Living area fraction									fLA = Living area / (4) =			0.7182	(91)
MIT	19.0100	19.4147	19.8789	20.3555	20.6161	20.7285	20.7547	20.7505	20.6727	20.2969	19.6008	18.9477	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8600	19.2647	19.7289	20.2055	20.4661	20.5785	20.6047	20.6005	20.5227	20.1469	19.4508	18.7977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8793	0.8238	0.7462	0.6175	0.4723	0.3317	0.2368	0.2706	0.4470	0.6827	0.8303	0.8911	(94)
Useful gains	473.0002	534.5652	557.6757	535.7339	450.0149	315.8435	214.8838	223.6615	330.1635	426.7573	449.3104	453.8891	(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	823.1221	809.4890	743.0941	624.8517	482.9151	323.9574	217.0035	226.8551	350.3422	525.9295	684.8528	814.7159	(97)
Space heating kWh	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98a)
Space heating requirement - total per year (kWh/year)												1183.6632	
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	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1183.6632	
Space heating per m2											(98c) / (4) =	19.7277	(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	509.3544	400.9811	410.4466	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9430	0.9642	0.9523	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	480.3134	386.6131	390.8546	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1073.6454	1023.5562	929.9301	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	427.1991	473.8856	401.0722	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	97.3658	108.0064	91.4110	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												296.7833	(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 %)	89.5000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	291.0510	206.4233	154.1355	71.6925	27.3495	0.0000	0.0000	0.0000	0.0000	82.4404	189.4866	299.9499	(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													
	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(64)
Efficiency of water heater													
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	249.2432	220.5494	234.5228	206.0816	198.0205	176.4876	173.3256	181.8391	185.4357	208.7722	221.5558	246.5635	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	22.6432	25.1178	21.2584	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	22.7377	20.5372	22.7377	22.0042	22.7377	22.0042	22.7377	22.7377	22.0042	22.7377	22.0042	22.7377	(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	1322.5287 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2502.3971 (219)
Space cooling fuel	69.0194 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, DataSheet: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	181.7175 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	267.7175 (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	4290.9996 (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	1322.5287	0.2100	277.7310	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2502.3971	0.2100	525.5034	(264)
Space and water heating			803.2344	(265)
Space cooling	69.0194	0.1143	7.8862	(266)
Pumps, fans and electric keep-hot	267.7175	0.1387	37.1357	(267)
Energy for lighting	129.3369	0.1443	18.6673	(268)
Total CO2, kg/year			866.9236	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.4500	(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	1322.5287	1.1300	1494.4574	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2502.3971	1.1300	2827.7087	(278)
Space and water heating			4322.1661	(279)
Space cooling	69.0194	1.4211	98.0830	(280)
Pumps, fans and electric keep-hot	267.7175	1.5128	405.0031	(281)
Energy for lighting	129.3369	1.5338	198.3813	(282)
Total Primary energy kWh/year			5023.6335	(286)
Dwelling Primary energy Rate (DPER)			83.7300	(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	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)

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) =	0.1166	(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)

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

K1 Element	Length	Psi-value	Total
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:

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 50.9589	46.0274	50.9589	48.8471	48.6661	45.2158	45.9864	47.4503	47.4124	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(62)
WWHRS -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)
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

189.3570	167.5733	178.6738	158.5883	153.1326	137.3375	135.7995	142.1938	144.6318	161.7017	169.8013	187.5831	(64)

Total per year (kWh/year) = Sum(64)m = 1926.3737 (64)

12Total per year (kWh/year) 1926 (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

69.9675	61.8355	65.5870	57.2974	54.9135	48.7902	47.7857	50.1984	51.2718	57.9239	61.8638	69.1701	(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)	94.0424	92.0171	88.1545	79.5798	73.8084	67.7642	64.2280	67.4710	71.2109	77.8547	85.9219	92.9706	(72)
Total internal gains	409.9457	419.0613	401.3300	386.0352	365.2028	347.6439	333.5691	335.0174	346.1875	362.5514	385.6796	401.2430	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	513.3250	604.7296	680.8029	774.9459	839.7262	835.8514	797.1305	732.0912	663.1465	574.6119	511.2479	488.5858	(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	25.3347	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	0.9397	0.9090	0.8613	0.7678	0.6381	0.4873	0.3694	0.4132	0.6111	0.8148	0.9119	0.9461	(86)
MIT	18.7170	19.0731	19.5594	20.1587	20.6067	20.8655	20.9535	20.9361	20.7415	20.1441	19.3386	18.6580	(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	0.9348	0.9019	0.8506	0.7503	0.6117	0.4508	0.3246	0.3668	0.5751	0.7967	0.9040	0.9417	(89)
MIT 2	18.2444	18.5958	19.0735	19.6571	20.0784	20.3140	20.3855	20.3743	20.2098	19.6532	18.8662	18.1901	(90)
Living area fraction									fLA = Living area / (4) =			0.7182	(91)
MIT	18.5838	18.9386	19.4225	20.0173	20.4578	20.7100	20.7935	20.7778	20.5917	20.0057	19.2054	18.5262	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5838	18.9386	19.4225	20.0173	20.4578	20.7100	20.7935	20.7778	20.5917	20.0057	19.2054	18.5262	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9168	0.8817	0.8308	0.7380	0.6140	0.4695	0.3538	0.3958	0.5865	0.7832	0.8849	0.9246	(94)
Useful gains	470.5917	533.1611	565.6298	571.9033	515.5537	392.4141	282.0488	289.7804	388.9113	450.0136	452.3802	451.7595	(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	1031.6038	1011.4556	928.8442	790.2119	621.1898	429.1339	294.5244	306.9070	457.6788	667.1487	862.2976	1025.0153	(97)
Space heating kWh	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98a)
Space heating requirement - total per year (kWh/year)												2128.0053	
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	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2128.0053	
Space heating per m2										(98c) / (4) =		35.4668	(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 %)	92.4000	(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	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	451.7241	347.8505	292.4584	170.1105	85.0576	0.0000	0.0000	0.0000	0.0000	174.8361	319.4162	461.5826	(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	189.3570	167.5733	178.6738	158.5883	153.1326	137.3375	135.7995	142.1938	144.6318	161.7017	169.8013	187.5831	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0247	85.7527	85.2654	84.3623	83.0240	80.3000	80.3000	80.3000	80.3000	84.3794	85.5537	86.0838	(217)
Fuel for water heating, kWh/month	220.1192	195.4146	209.5503	187.9846	184.4437	171.0306	169.1152	177.0782	180.1144	191.6365	198.4733	217.9076	(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	2303.0360 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2302.8682 (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	4245.0537 (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	2303.0360	0.2100	483.6376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2302.8682	0.2100	483.6023	(264)
Space and water heating			967.2399	(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			923.2857	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900	(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	2303.0360	1.1300	2602.4307	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2302.8682	1.1300	2602.2410	(278)
Space and water heating			5204.6717	(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			4935.7838	(286)
Target Primary Energy Rate (TPER)			82.2600	(287)

Full SAP Calculation Printout

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

SAP Rating	83 B	DER	14.45	TER	15.39
Environmental	89 B	% DER < TER			6.11
CO_2 Emissions (t/year)	0.77	DFEE	39.94	TFEE	40.44
Compliance Check	See BREL	% DFEE < TFEE			1.23
% DPER < TPER	-1.78	DPER	83.73	TPER	82.26

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) =	81.0000 (23c)

Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448	(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	14.5852	14.4047	14.2242	13.3217	13.1412	12.2387	12.2387	12.0582	12.5997	13.1412	13.5022	13.8632	(38)
Heat transfer coeff	56.5332	56.3527	56.1722	55.2696	55.0891	54.1866	54.1866	54.0061	54.5476	55.0891	55.4502	55.8112	(39)
Average = Sum(39)m / 12 =												55.2245	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9422	0.9392	0.9362	0.9212	0.9182	0.9031	0.9031	0.9001	0.9091	0.9182	0.9242	0.9302	(40)
HLP (average)												0.9204	
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:													
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	50.9589	46.0274	50.9589	48.8471	48.6661	45.2158	45.9864	47.4503	47.4124	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(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	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(64)
									Total per year (kWh/year) = Sum(64)m =			2239.6454	(64)
12Total per year (kWh/year)												2240	(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	69.9675	61.8355	65.5870	57.2974	54.9135	48.7902	47.7857	50.1984	51.2718	57.9239	61.8638	69.1701	(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)	94.0424	92.0171	88.1545	79.5798	73.8084	67.7642	64.2280	67.4710	71.2109	77.8547	85.9219	92.9706 (72)
Total internal gains	409.9457	419.0613	401.3300	386.0352	365.2028	347.6439	333.5691	335.0174	346.1875	362.5514	385.6796	401.2430 (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	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	537.9294	648.9250	747.3420	867.5639	952.7512	952.1433	907.5486	826.6604	738.6184	625.0936	541.1344	509.3728 (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	29.4173	29.5115	29.6064	30.0898	30.1884	30.6912	30.6912	30.7938	30.4881	30.1884	29.9919	29.7979	
alpha	2.9612	2.9674	2.9738	3.0060	3.0126	3.0461	3.0461	3.0529	3.0325	3.0126	2.9995	2.9865	
util living area	0.9088	0.8568	0.7796	0.6461	0.4959	0.3534	0.2594	0.2951	0.4749	0.7172	0.8638	0.9191	(86)
MIT	19.3305	19.7102	20.1476	20.5999	20.8525	20.9615	20.9888	20.9834	20.9050	20.5388	19.8799	19.2704	(87)
Th 2	20.1318	20.1343	20.1368	20.1496	20.1521	20.1649	20.1649	20.1674	20.1597	20.1521	20.1470	20.1419	(88)
util rest of house	0.8981	0.8413	0.7575	0.6154	0.4581	0.3101	0.2113	0.2435	0.4251	0.6829	0.8464	0.9094	(89)
MIT 2	18.1933	18.6618	19.1940	19.7329	20.0135	20.1349	20.1583	20.1572	20.0807	19.6804	18.8894	18.1256	(90)
Living area fraction									fLA = Living area / (4) =			0.7182	(91)
MIT	19.0100	19.4147	19.8789	20.3555	20.6161	20.7285	20.7547	20.7505	20.6727	20.2969	19.6008	18.9477	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8600	19.2647	19.7289	20.2055	20.4661	20.5785	20.6047	20.6005	20.5227	20.1469	19.4508	18.7977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8793	0.8238	0.7462	0.6175	0.4723	0.3317	0.2368	0.2706	0.4470	0.6827	0.8303	0.8911	(94)
Useful gains	473.0002	534.5652	557.6757	535.7339	450.0149	315.8435	214.8838	223.6615	330.1635	426.7573	449.3104	453.8891	(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	823.1221	809.4890	743.0941	624.8517	482.9151	323.9574	217.0035	226.8551	350.3422	525.9295	684.8528	814.7159	(97)
Space heating kWh	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98a)
Space heating requirement - total per year (kWh/year)												1183.6632	
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	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1183.6632	
Space heating per m2											(98c) / (4) =	19.7277	(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	509.3544	400.9811	410.4466	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9430	0.9642	0.9523	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	480.3134	386.6131	390.8546	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1073.6454	1023.5562	929.9301	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	427.1991	473.8856	401.0722	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	97.3658	108.0064	91.4110	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												296.7833	(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 %)	89.5000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	260.4907	184.7488	137.9513	64.1648	24.4778	0.0000	0.0000	0.0000	0.0000	73.7841	169.5905	268.4552	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	291.0510	206.4233	154.1355	71.6925	27.3495	0.0000	0.0000	0.0000	0.0000	82.4404	189.4866	299.9499	(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													
	223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(64)
Efficiency of water heater													
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	249.2432	220.5494	234.5228	206.0816	198.0205	176.4876	173.3256	181.8391	185.4357	208.7722	221.5558	246.5635	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	22.6432	25.1178	21.2584	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	22.7377	20.5372	22.7377	22.0042	22.7377	22.0042	22.7377	22.7377	22.0042	22.7377	22.0042	22.7377	(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	1322.5287 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2502.3971 (219)
Space cooling fuel	69.0194 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, DataSheet: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	181.7175 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	267.7175 (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	4290.9996 (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	1322.5287	0.2100	277.7310	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2502.3971	0.2100	525.5034	(264)
Space and water heating			803.2344	(265)
Space cooling	69.0194	0.1143	7.8862	(266)
Pumps, fans and electric keep-hot	267.7175	0.1387	37.1357	(267)
Energy for lighting	129.3369	0.1443	18.6673	(268)
Total CO2, kg/year			866.9236	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.4500	(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	1322.5287	1.1300	1494.4574	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2502.3971	1.1300	2827.7087	(278)
Space and water heating			4322.1661	(279)
Space cooling	69.0194	1.4211	98.0830	(280)
Pumps, fans and electric keep-hot	267.7175	1.5128	405.0031	(281)
Energy for lighting	129.3369	1.5338	198.3813	(282)
Total Primary energy kWh/year			5023.6335	(286)
Dwelling Primary energy Rate (DPER)			83.7300	(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	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)

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) =	0.1166	(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)

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

K1 Element	Length	Psi-value	Total
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:

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 50.9589	46.0274	50.9589	48.8471	48.6661	45.2158	45.9864	47.4503	47.4124	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

223.0726	197.3917	209.8979	184.4430	177.2284	157.9564	155.1264	162.7460	165.9649	186.8511	198.2925	220.6744	(62)
WWHRS -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)
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

189.3570	167.5733	178.6738	158.5883	153.1326	137.3375	135.7995	142.1938	144.6318	161.7017	169.8013	187.5831	(64)

Total per year (kWh/year) = Sum(64)m = 1926.3737 (64)

12Total per year (kWh/year) 1926 (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

69.9675	61.8355	65.5870	57.2974	54.9135	48.7902	47.7857	50.1984	51.2718	57.9239	61.8638	69.1701	(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)	94.0424	92.0171	88.1545	79.5798	73.8084	67.7642	64.2280	67.4710	71.2109	77.8547	85.9219	92.9706	(72)
Total internal gains	409.9457	419.0613	401.3300	386.0352	365.2028	347.6439	333.5691	335.0174	346.1875	362.5514	385.6796	401.2430	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	513.3250	604.7296	680.8029	774.9459	839.7262	835.8514	797.1305	732.0912	663.1465	574.6119	511.2479	488.5858	(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	25.3347	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	0.9397	0.9090	0.8613	0.7678	0.6381	0.4873	0.3694	0.4132	0.6111	0.8148	0.9119	0.9461	(86)
MIT	18.7170	19.0731	19.5594	20.1587	20.6067	20.8655	20.9535	20.9361	20.7415	20.1441	19.3386	18.6580	(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	0.9348	0.9019	0.8506	0.7503	0.6117	0.4508	0.3246	0.3668	0.5751	0.7967	0.9040	0.9417	(89)
MIT 2	18.2444	18.5958	19.0735	19.6571	20.0784	20.3140	20.3855	20.3743	20.2098	19.6532	18.8662	18.1901	(90)
Living area fraction									fLA = Living area / (4) =			0.7182	(91)
MIT	18.5838	18.9386	19.4225	20.0173	20.4578	20.7100	20.7935	20.7778	20.5917	20.0057	19.2054	18.5262	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5838	18.9386	19.4225	20.0173	20.4578	20.7100	20.7935	20.7778	20.5917	20.0057	19.2054	18.5262	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9168	0.8817	0.8308	0.7380	0.6140	0.4695	0.3538	0.3958	0.5865	0.7832	0.8849	0.9246	(94)
Useful gains	470.5917	533.1611	565.6298	571.9033	515.5537	392.4141	282.0488	289.7804	388.9113	450.0136	452.3802	451.7595	(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	1031.6038	1011.4556	928.8442	790.2119	621.1898	429.1339	294.5244	306.9070	457.6788	667.1487	862.2976	1025.0153	(97)
Space heating kWh	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98a)
Space heating requirement - total per year (kWh/year)												2128.0053	
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	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2128.0053	
Space heating per m2										(98c) / (4) =		35.4668	(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 %)	92.4000	(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	417.3931	321.4139	270.2315	157.1821	78.5932	0.0000	0.0000	0.0000	0.0000	161.5485	295.1405	426.5023	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	451.7241	347.8505	292.4584	170.1105	85.0576	0.0000	0.0000	0.0000	0.0000	174.8361	319.4162	461.5826	(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	189.3570	167.5733	178.6738	158.5883	153.1326	137.3375	135.7995	142.1938	144.6318	161.7017	169.8013	187.5831	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0247	85.7527	85.2654	84.3623	83.0240	80.3000	80.3000	80.3000	80.3000	84.3794	85.5537	86.0838	(217)
Fuel for water heating, kWh/month	220.1192	195.4146	209.5503	187.9846	184.4437	171.0306	169.1152	177.0782	180.1144	191.6365	198.4733	217.9076	(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	2303.0360 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2302.8682 (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	4245.0537 (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	2303.0360	0.2100	483.6376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2302.8682	0.2100	483.6023	(264)
Space and water heating			967.2399	(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			923.2857	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.3900	(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	2303.0360	1.1300	2602.4307	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2302.8682	1.1300	2602.2410	(278)
Space and water heating			5204.6717	(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			4935.7838	(286)
Target Primary Energy Rate (TPER)			82.2600	(287)

Full SAP Calculation Printout

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

SAP Rating	84 B	DER	11.11	TER	13.83
Environmental	89 B	% DER < TER			19.67
CO_2 Emissions (t/year)	1.24	DFEE	42.19	TFEE	49.71
Compliance Check	See BREL	% DFEE < TFEE			15.13
% DPER < TPER	11.16	DPER	65.18	TPER	73.37

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)

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 = 0.95)			36.3200	0.9152	33.2408		(27)
Solid Door			1.8700	0.9500	1.7765		(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) =		87.5480		(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) = 104.0342 (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	134.6055	134.2063	133.8070	131.8107	131.4114	129.4151	129.4151	129.0158	130.2136	131.4114	132.2099	133.0085	(39)
Average = Sum(39)m / 12 =												131.7108	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0649	1.0618	1.0586	1.0428	1.0396	1.0239	1.0239	1.0207	1.0302	1.0396	1.0460	1.0523	(40)
HLP (average)												1.0420	
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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	285.5248	252.4266	267.8138	234.4473	226.6111	203.4695	200.2042	208.5060	211.1994	236.3918	252.4703	282.2579	(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	285.5248	252.4266	267.8138	234.4473	226.6111	203.4695	200.2042	208.5060	211.1994	236.3918	252.4703	282.2579	(64)
										Total per year (kWh/year) = Sum(64)m =		2861.3227	(64)
12Total per year (kWh/year)												2861	(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

90.7329	80.1346	84.8440	73.8852	71.1441	63.5851	62.3638	65.1242	66.1553	74.3961	79.8779	89.6466	(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	0.0000	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)													
	121.9528	119.2479	114.0376	102.6184	95.6238	88.3126	83.8223	87.5325	91.8824	99.9948	110.9415	120.4928	(72)
Total internal gains													
	632.5049	648.6956	619.9632	597.1465	564.6075	539.8550	517.4906	518.1570	535.1088	557.6188	594.1099	618.1025	(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	1257.4622	1720.6202	2106.2495	2471.6340	2694.2255	2667.2845	2563.0616	2371.3693	2155.5187	1747.6173	1344.0106	1152.0647	(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	18.3577	18.4123	18.4673	18.7470	18.8039	19.0940	19.0940	19.1531	18.9769	18.8039	18.6904	18.5781	
alpha	2.2238	2.2275	2.2312	2.2498	2.2536	2.2729	2.2729	2.2769	2.2651	2.2536	2.2460	2.2385	
util living area													
	0.8570	0.7644	0.6617	0.5328	0.4084	0.2952	0.2165	0.2422	0.3813	0.6042	0.7914	0.8755	(86)
MIT	18.6170	19.2761	19.8843	20.4281	20.7494	20.9152	20.9697	20.9601	20.8417	20.3600	19.4107	18.4900	(87)
Th 2	20.0296	20.0322	20.0348	20.0478	20.0504	20.0635	20.0635	20.0661	20.0583	20.0504	20.0452	20.0400	(88)
util rest of house													
	0.8433	0.7451	0.6370	0.5028	0.3736	0.2554	0.1721	0.1954	0.3363	0.5687	0.7705	0.8633	(89)
MIT 2	17.2715	18.0754	18.8062	19.4499	19.8107	19.9950	20.0447	20.0403	19.9233	19.3955	18.2658	17.1203	(90)
Living area fraction										fLA = Living area / (4) =		0.3052	(91)
MIT	17.6822	18.4419	19.1353	19.7485	20.0972	20.2759	20.3271	20.3211	20.2036	19.6899	18.6153	17.5384	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5322	18.2919	18.9853	19.5985	19.9472	20.1259	20.1771	20.1711	20.0536	19.5399	18.4653	17.3884	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7990	0.7051	0.6076	0.4879	0.3697	0.2581	0.1776	0.2007	0.3361	0.5481	0.7295	0.8199	(94)
Useful gains	1004.7493	1213.1454	1279.6592	1205.8347	996.0323	688.5048	455.1416	475.9696	724.4792	957.8849	980.5082	944.6190	(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													
	1781.1271	1797.2731	1670.6178	1410.1739	1083.7740	715.1314	462.9266	486.5272	775.2443	1174.8030	1502.5999	1754.1647	(97)
Space heating kWh													
	577.6251	392.5338	290.8732	147.1243	65.2798	0.0000	0.0000	0.0000	0.0000	161.3870	375.9060	602.3020	(98a)
Space heating requirement - total per year (kWh/year)												2613.0312	
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													
	577.6251	392.5338	290.8732	147.1243	65.2798	0.0000	0.0000	0.0000	0.0000	161.3870	375.9060	602.3020	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2613.0312	
Space heating per m2											(98c) / (4) =	20.6727	(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	1216.5015	957.6714	980.5200	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9215	0.9455	0.9344	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1121.0176	905.4678	916.1710	0.0000	0.0000	0.0000	0.0000	(102)

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3045.3746	2926.7515	2704.5559	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1385.5370	1503.8351	1330.5584	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	251.0738	272.5106	241.1111	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												764.6955 (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 %)	89.5000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	577.6251	392.5338	290.8732	147.1243	65.2798	0.0000	0.0000	0.0000	0.0000	161.3870	375.9060	602.3020	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	645.3912	438.5853	324.9980	164.3847	72.9383	0.0000	0.0000	0.0000	0.0000	180.3207	420.0067	672.9632	(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	285.5248	252.4266	267.8138	234.4473	226.6111	203.4695	200.2042	208.5060	211.1994	236.3918	252.4703	282.2579	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	319.0221	282.0409	299.2333	261.9523	253.1968	227.3402	223.6918	232.9676	235.9769	264.1249	282.0897	315.3719	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	58.3893	63.3746	56.0723	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	41.4429	37.4323	41.4429	40.1060	41.4429	40.1060	41.4429	41.4429	40.1060	41.4429	40.1060	41.4429	(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	2919.5880 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	3197.0086 (219)
Space cooling fuel	177.8362 (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)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	487.9567 (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	7001.7517 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	2919.5880	0.2100	613.1135	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3197.0086	0.2100	671.3718	(264)
Space and water heating			1284.4853	(265)
Space cooling	177.8362	0.1143	20.3214	(266)
Pumps, fans and electric keep-hot	487.9567	0.1387	67.6856	(267)
Energy for lighting	219.3623	0.1443	31.6608	(268)
Total CO2, kg/year			1404.1530	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.1100	(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	2919.5880	1.1300	3299.1344	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3197.0086	1.1300	3612.6197	(278)
Space and water heating			6911.7541	(279)
Space cooling	177.8362	1.4211	252.7273	(280)
Pumps, fans and electric keep-hot	487.9567	1.5128	738.1808	(281)
Energy for lighting	219.3623	1.5338	336.4652	(282)
Total Primary energy kWh/year			8239.1274	(286)
Dwelling Primary energy Rate (DPER)			65.1800	(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		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	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

	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	0.5600	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	285.5248	252.4266	267.8138	234.4473	226.6111	203.4695	200.2042	208.5060	211.1994	236.3918	252.4703	282.2579	(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	252.3388	223.0767	237.0802	208.9987	202.8939	183.1745	181.1809	188.2767	190.2014	211.6375	224.4267	249.6865	(64)

Total per year (kWh/year) = Sum(64)m = 2552.9723 (64)

12Total per year (kWh/year) 2553 (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	90.7329	80.1346	84.8440	73.8852	71.1441	63.5851	62.3638	65.1242	66.1553	74.3961	79.8779	89.6466	(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)
121.9528 119.2479 114.0376 102.6184 95.6238 88.3126 83.8223 87.5325 91.8824 99.9948 110.9415 120.4928 (72)
Total internal gains
632.5049 648.6956 619.9632 597.1465 564.6075 539.8550 517.4906 518.1570 535.1088 557.6188 594.1099 618.1025 (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	935.8226	1169.8935	1345.1363	1515.8644	1612.0796	1587.8598	1524.5051	1427.8756	1327.1148	1136.9018	958.2406	877.1448	(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	0.9246	0.8884	0.8427	0.7688	0.6712	0.5484	0.4361	0.4719	0.6359	0.8040	0.8962	0.9323	(86)
MIT	17.1704	17.6694	18.3487	19.1938	19.9405	20.5052	20.7759	20.7303	20.2945	19.2986	18.0829	17.0796	(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	0.9147	0.8743	0.8224	0.7376	0.6229	0.4742	0.3344	0.3708	0.5675	0.7704	0.8806	0.9234	(89)
MIT 2	15.3882	16.0015	16.8344	17.8579	18.7333	19.3593	19.6187	19.5854	19.1525	18.0108	16.5279	15.2779	(90)
Living area fraction										fLA = Living area / (4) =		0.3052	(91)
MIT	15.9322	16.5106	17.2966	18.2657	19.1017	19.7091	19.9719	19.9348	19.5011	18.4038	17.0025	15.8278	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9322	16.5106	17.2966	18.2657	19.1017	19.7091	19.9719	19.9348	19.5011	18.4038	17.0025	15.8278	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8710	0.8248	0.7717	0.6934	0.5951	0.4719	0.3543	0.3874	0.5526	0.7254	0.8329	0.8818	(94)
Useful gains	815.1303	964.9653	1038.0885	1051.0752	959.3144	749.2752	540.0628	553.1607	733.3028	824.6647	798.0966	773.4679	(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	2143.5877	2135.4213	1981.8911	1703.6683	1344.1171	920.3902	607.4375	635.8465	976.0039	1417.1380	1804.4752	2126.5022	(97)
Space heating kWh	988.3723	786.5464	702.1892	469.8670	286.2932	0.0000	0.0000	0.0000	0.0000	440.8001	724.5926	1006.6575	(98a)
Space heating requirement - total per year (kWh/year)												5405.3184	
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	988.3723	786.5464	702.1892	469.8670	286.2932	0.0000	0.0000	0.0000	0.0000	440.8001	724.5926	1006.6575	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5405.3184	
Space heating per m2											(98c) / (4) =	42.7636	(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 %) 92.4000 (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	988.3723	786.5464	702.1892	469.8670	286.2932	0.0000	0.0000	0.0000	0.0000	440.8001	724.5926	1006.6575	(98)
Space heating efficiency (main heating system 1)													

	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)												
	1069.6670	851.2407	759.9450	508.5141	309.8411	0.0000	0.0000	0.0000	0.0000	477.0564	784.1911	1089.4562 (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												
	252.3388	223.0767	237.0802	208.9987	202.8939	183.1745	181.1809	188.2767	190.2014	211.6375	224.4267	249.6865 (64)
Efficiency of water heater												80.3000 (216)
(217)m	87.0049	86.8450	86.5601	86.0624	85.1190	80.3000	80.3000	80.3000	80.3000	85.9153	86.7041	87.0472 (217)
Fuel for water heating, kWh/month												
	290.0284	256.8678	273.8910	242.8456	238.3649	228.1127	225.6300	234.4666	236.8635	246.3328	258.8422	286.8402 (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	5849.9117 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3019.0857 (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	7953.5680 (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	5849.9117	0.2100	1228.4814	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3019.0857	0.2100	634.0080	(264)
Space and water heating			1862.4895	(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			1748.1846	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.8300	(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	5849.9117	1.1300	6610.4002	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3019.0857	1.1300	3411.5669	(278)
Space and water heating			10021.9671	(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			9274.1225 (286)
Target Primary Energy Rate (TPER)			73.3700 (287)

Full SAP Calculation Printout

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

SAP Rating	85 B	DER	12.48	TER	14.67
Environmental	89 B	% DER < TER			14.93
CO_2 Emissions (t/year)	0.96	DFEE	36.82	TFEE	43.28
Compliance Check	See BREL	% DFEE < TFEE			14.94
% DPER < TPER	8.02	DPER	71.83	TPER	78.09

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) =	227.4400	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.4400	(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	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		85.5588 (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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(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	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(64)
									Total per year (kWh/year) = Sum(64)m =			2711.0357	(64)
12Total per year (kWh/year)												2711	(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	85.5494	75.5736	80.0520	69.7943	67.2627	60.1787	59.0658	61.6427	62.5779	70.2984	75.3885	84.5353	(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	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)													
	114.9857	112.4608	107.5968	96.9365	90.4068	83.5816	79.3896	82.8531	86.9138	94.4871	104.7062	113.6227	(72)
Total internal gains													
	535.4430	548.2331	524.3420	504.5849	477.5118	456.1476	437.5664	438.5878	452.8076	472.4777	503.2403	523.6957	(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	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	611.2705	687.0338	739.8567	814.5301	863.8442	856.9150	816.7792	758.1781	700.6083	632.7849	595.8194	587.4525	(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	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													
	0.9254	0.8959	0.8511	0.7567	0.6251	0.4670	0.3491	0.3882	0.5839	0.7924	0.8933	0.9320	(86)
MIT	19.2524	19.5302	19.9062	20.3905	20.7336	20.9217	20.9761	20.9666	20.8402	20.3982	19.7714	19.2138	(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													
	0.9176	0.8854	0.8361	0.7332	0.5908	0.4219	0.2959	0.3329	0.5376	0.7668	0.8809	0.9248	(89)
MIT 2	18.1953	18.5437	19.0126	19.6093	20.0108	20.2232	20.2744	20.2692	20.1403	19.6315	18.8584	18.1527	(90)
Living area fraction									fLA = Living area / (4) =			0.5440	(91)
MIT	18.7704	19.0803	19.4987	20.0342	20.4040	20.6031	20.6561	20.6486	20.5210	20.0486	19.3550	18.7299	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6204	18.9303	19.3487	19.8842	20.2540	20.4531	20.5061	20.4986	20.3710	19.8986	19.2050	18.5799	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8961	0.8628	0.8147	0.7193	0.5895	0.4325	0.3123	0.3493	0.5434	0.7518	0.8592	0.9041	(94)
Useful gains	547.7596	592.7533	602.7491	585.9256	509.2508	370.6145	255.0668	264.8076	380.6791	475.7234	511.9088	531.1398	(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													
	994.7587	971.5555	886.9364	746.2737	579.2976	390.0182	260.2778	272.2129	420.5926	629.7245	825.0569	986.3716	(97)
Space heating kWh													
	332.5673	254.5551	211.4354	115.4506	52.1148	0.0000	0.0000	0.0000	0.0000	114.5768	225.4666	338.6925	(98a)
Space heating requirement - total per year (kWh/year)												1644.8590	
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													
	332.5673	254.5551	211.4354	115.4506	52.1148	0.0000	0.0000	0.0000	0.0000	114.5768	225.4666	338.6925	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1644.8590	
Space heating per m2											(98c) / (4) =	18.6916	(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 %)												89.5000	(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													
	332.5673	254.5551	211.4354	115.4506	52.1148	0.0000	0.0000	0.0000	0.0000	114.5768	225.4666	338.6925	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	371.5836	284.4191	236.2407	128.9951	58.2288	0.0000	0.0000	0.0000	0.0000	128.0187	251.9180	378.4273	(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
269.9353 238.7094 253.4020 222.1437 214.9377 193.2248 190.2855 198.0355 200.4404 224.0677 238.9684 266.8855 (64)
Efficiency of water heater 89.5000 (216)
(217)m 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 (217)
Fuel for water heating, kWh/month
301.6037 266.7145 283.1307 248.2053 240.1538 215.8936 212.6095 221.2687 223.9557 250.3549 267.0038 298.1961 (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 30.6410 27.6757 30.6410 29.6526 30.6410 29.6526 30.6410 30.6410 29.6526 30.6410 29.6526 30.6410 (231)
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 (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 1837.8313 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.5000
Water heating fuel used 3029.0902 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)
mechanical ventilation fans (SFP = 0.9920) 274.7729 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 360.7729 (231)
Electricity for lighting (calculated in Appendix L) 179.6829 (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 5407.3773 (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	1837.8313	0.2100	385.9446	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3029.0902	0.2100	636.1089	(264)
Space and water heating			1022.0535	(265)
Pumps, fans and electric keep-hot	360.7729	0.1387	50.0436	(267)
Energy for lighting	179.6829	0.1443	25.9338	(268)
Total CO2, kg/year			1098.0310	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.4800	(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	1837.8313	1.1300	2076.7494	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3029.0902	1.1300	3422.8719	(278)
Space and water heating			5499.6213	(279)
Pumps, fans and electric keep-hot	360.7729	1.5128	545.7772	(281)
Energy for lighting	179.6829	1.5338	275.6036	(282)
Total Primary energy kWh/year			6321.0022	(286)
Dwelling Primary energy Rate (DPER)			71.8300	(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	88.0000	(1b)	x 2.5800	(2b) =	227.4400	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 88.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.4400	(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) =	0.1321 (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 95.5588 (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	

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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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(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													
	238.9543	211.3096	224.7104	198.3860	192.7963	174.2782	172.5262	179.1502	180.8376	200.9581	212.7881	236.4782	(64)
										Total per year (kWh/year) = Sum(64)m =		2423.1732	(64)
12Total per year (kWh/year)												2423	(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													
	85.5494	75.5736	80.0520	69.7943	67.2627	60.1787	59.0658	61.6427	62.5779	70.2984	75.3885	84.5353	(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	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)													
	114.9857	112.4608	107.5968	96.9365	90.4068	83.5816	79.3896	82.8531	86.9138	94.4871	104.7062	113.6227	(72)
Total internal gains													
	535.4430	548.2331	524.3420	504.5849	477.5118	456.1476	437.5664	438.5878	452.8076	472.4777	503.2403	523.6957	(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	0.6300	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	637.0841	734.2852	813.2234	920.0433	995.3616	993.3464	945.8728	866.9749	784.9660	687.3576	627.3357	609.1569	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
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	0.9474	0.9253	0.8905	0.8175	0.7070	0.5638	0.4412	0.4890	0.6835	0.8538	0.9264	0.9523	(86)
MIT	18.2487	18.5803	19.0876	19.7709	20.3526	20.7434	20.8996	20.8676	20.5609	19.8077	18.9219	18.1918	(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	0.9398	0.9147	0.8746	0.7902	0.6616	0.4936	0.3481	0.3947	0.6195	0.8257	0.9142	0.9455	(89)
MIT 2	16.7117	17.1294	17.7656	18.6098	19.2968	19.7276	19.8726	19.8508	19.5507	18.6752	17.5720	16.6441	(90)
Living area fraction										fLA = Living area / (4) =		0.5440	(91)
MIT	17.5478	17.9187	18.4848	19.2414	19.8711	20.2802	20.4312	20.4039	20.1002	19.2913	18.3063	17.4860	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5478	17.9187	18.4848	19.2414	19.8711	20.2802	20.4312	20.4039	20.1002	19.2913	18.3063	17.4860	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9175	0.8896	0.8487	0.7703	0.6593	0.5178	0.3933	0.4382	0.6308	0.8060	0.8903	0.9243	(94)
Useful gains	584.5294	653.2071	690.1422	708.6949	656.2156	514.3401	371.9821	379.9025	495.1602	554.0101	558.5270	563.0223	(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	1416.7772	1389.5720	1276.7806	1091.8312	861.2371	593.9685	400.6252	418.0657	629.3539	916.0597	1185.1944	1410.1685	(97)
Space heating kWh	619.1924	494.8372	436.4589	275.8581	152.5360	0.0000	0.0000	0.0000	0.0000	269.3649	451.2005	630.2768	(98a)
Space heating requirement - total per year (kWh/year)												3329.7248	
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	619.1924	494.8372	436.4589	275.8581	152.5360	0.0000	0.0000	0.0000	0.0000	269.3649	451.2005	630.2768	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3329.7248	
Space heating per m2											(98c) / (4) =	37.8378	(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 %)												92.4000	(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	619.1924	494.8372	436.4589	275.8581	152.5360	0.0000	0.0000	0.0000	0.0000	269.3649	451.2005	630.2768	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	670.1216	535.5381	472.3581	298.5477	165.0822	0.0000	0.0000	0.0000	0.0000	291.5205	488.3123	682.1177	(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	238.9543	211.3096	224.7104	198.3860	192.7963	174.2782	172.5262	179.1502	180.8376	200.9581	212.7881	236.4782	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.3256	86.1394	85.7777	85.0879	83.8844	80.3000	80.3000	80.3000	80.3000	85.0099	85.9500	86.3761	(217)
Fuel for water heating, kWh/month	276.8058	245.3113	261.9682	233.1541	229.8358	217.0339	214.8521	223.1011	225.2024	236.3938	247.5718	273.7773	(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	3603.5983 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2885.0077 (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	5906.1576 (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	3603.5983	0.2100	756.7556	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2885.0077	0.2100	605.8516	(264)
Space and water heating			1362.6073	(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			1290.7348	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.6700	(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	3603.5983	1.1300	4072.0661	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2885.0077	1.1300	3260.0587	(278)
Space and water heating			7332.1248	(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			6871.5880	(286)
Target Primary Energy Rate (TPER)			78.0900	(287)

Full SAP Calculation Printout

Property Reference	Flat 101 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 101 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	83 B	DER	15.91	TER	17.36
Environmental	88 B	% DER < TER			8.35
CO_2 Emissions (t/year)	0.87	DFEE	42.99	TFEE	46.93
Compliance Check	See BREL	% DFEE < TFEE			8.38
% DPER < TPER	2.72	DPER	90.65	TPER	93.19

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)

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	
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:

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 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

243.1137	215.0818	228.5579	200.9420	194.8158	175.5642	173.2098	180.0254	181.9471	202.8802	215.7439	240.4432	(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

243.1137	215.0818	228.5579	200.9420	194.8158	175.5642	173.2098	180.0254	181.9471	202.8802	215.7439	240.4432	(64)

Total per year (kWh/year) = Sum(64)m = 2452.3250 (64)

12Total per year (kWh/year) 2452 (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

76.6312	67.7174	71.7914	62.7447	60.5721	54.3066	53.3881	55.6543	56.4289	63.2536	67.6663	75.7433	(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	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)													
	102.9989	100.7700	96.4938	87.1454	81.4142	75.4258	71.7583	74.8042	78.3735	85.0182	93.9810	101.8055	(72)
Total internal gains													
	423.1074	432.1814	413.8348	397.6687	376.6573	359.0305	344.6711	345.8963	357.0038	373.4663	397.7092	414.1721	(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	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	563.7949	677.5663	764.8331	858.1372	915.7546	904.4932	866.2840	807.2795	745.6656	648.7813	567.2661	533.8946	(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	16.3298	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													
	0.8553	0.8026	0.7373	0.6358	0.5178	0.3912	0.2949	0.3255	0.4827	0.6796	0.8088	0.8668	(86)
MIT	18.3354	18.8001	19.3660	20.0180	20.5037	20.8079	20.9244	20.9044	20.6835	20.0333	19.0912	18.2534	(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													
	0.8424	0.7861	0.7159	0.6071	0.4802	0.3434	0.2379	0.2667	0.4329	0.6470	0.7901	0.8548	(89)
MIT 2	16.9578	17.5286	18.2208	19.0079	19.5712	19.9106	20.0231	20.0093	19.7866	19.0486	17.9060	16.8601	(90)
Living area fraction										fLA = Living area / (4) =		0.3654	(91)
MIT	17.4612	17.9932	18.6393	19.3770	19.9119	20.2385	20.3524	20.3364	20.1143	19.4084	18.3391	17.3692	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3112	17.8432	18.4893	19.2270	19.7619	20.0885	20.2024	20.1864	19.9643	19.2584	18.1891	17.2192	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7951	0.7401	0.6754	0.5794	0.4675	0.3443	0.2461	0.2740	0.4271	0.6157	0.7448	0.8083	(94)
Useful gains	448.2974	501.4571	516.5860	497.1684	428.1458	311.3813	213.1661	221.1965	318.4401	399.4579	422.5147	431.5313	(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													
	830.8175	824.3955	761.7041	647.7915	504.4111	338.9845	222.4960	233.2491	364.0811	541.7301	697.3792	822.9515	(97)
Space heating kWh													
	284.5949	217.0146	182.3679	108.4487	56.7414	0.0000	0.0000	0.0000	0.0000	105.8505	197.9025	291.2166	(98a)
Space heating requirement - total per year (kWh/year)												1444.1371	
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													
	284.5949	217.0146	182.3679	108.4487	56.7414	0.0000	0.0000	0.0000	0.0000	105.8505	197.9025	291.2166	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1444.1371	
Space heating per m2											(98c) / (4) =	23.6744	(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 %)	89.5000 (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													
	284.5949	217.0146	182.3679	108.4487	56.7414	0.0000	0.0000	0.0000	0.0000	105.8505	197.9025	291.2166	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	317.9832	242.4744	203.7630	121.1717	63.3982	0.0000	0.0000	0.0000	0.0000	118.2688	221.1201	325.3817	(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												
	243.1137	215.0818	228.5579	200.9420	194.8158	175.5642	173.2098	180.0254	181.9471	202.8802	215.7439	240.4432 (64)
Efficiency of water heater												89.5000 (216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (217)
Fuel for water heating, kWh/month												
	271.6354	240.3148	255.3720	224.5162	217.6713	196.1611	193.5305	201.1457	203.2929	226.6818	241.0546	268.6516 (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	22.3914	20.2245	22.3914	21.6691	22.3914	21.6691	22.3914	22.3914	21.6691	22.3914	21.6691	22.3914 (231)
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 (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	1613.5610 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2740.0279 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	177.6405 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	263.6405 (231)
Electricity for lighting (calculated in Appendix L)	137.8268 (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	4755.0563 (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	1613.5610	0.2100	338.8478	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2740.0279	0.2100	575.4059	(264)
Space and water heating			914.2537	(265)
Pumps, fans and electric keep-hot	263.6405	0.1387	36.5702	(267)
Energy for lighting	137.8268	0.1443	19.8927	(268)
Total CO2, kg/year			970.7165	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.9100	(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	1613.5610	1.1300	1823.3239	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2740.0279	1.1300	3096.2316	(278)
Space and water heating			4919.5555	(279)
Pumps, fans and electric keep-hot	263.6405	1.5128	398.8354	(281)
Energy for lighting	137.8268	1.5338	211.4034	(282)
Total Primary energy kWh/year			5529.7943	(286)
Dwelling Primary energy Rate (DPER)			90.6500	(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	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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(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													
	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.2560	(64)
12Total per year (kWh/year)												2157	(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													
	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(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)													
	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains													
	420.9360	430.0892	411.8546	395.9291	375.0665	357.5977	343.0554	344.4597	355.4704	371.7577	395.7734	412.0293	(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	537.5726	633.5177	702.8199	777.6113	821.8982	809.6946	775.3892	726.8901	677.6473	599.9938	536.3428	511.2858	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
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	0.9015	0.8676	0.8236	0.7486	0.6482	0.5232	0.4124	0.4474	0.6114	0.7786	0.8706	0.9093	(86)
MIT	17.5422	17.9711	18.5817	19.3643	20.0577	20.5717	20.8103	20.7700	20.3781	19.4763	18.3799	17.4605	(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	0.8894	0.8518	0.8019	0.7165	0.5999	0.4511	0.3162	0.3512	0.5437	0.7431	0.8525	0.8981	(89)
MIT 2	15.8449	16.3713	17.1200	18.0667	18.8767	19.4424	19.6690	19.6399	19.2545	18.2259	16.8913	15.7461	(90)
Living area fraction										fLA = Living area / (4) =		0.3654	(91)
MIT	16.4651	16.9559	17.6541	18.5409	19.3083	19.8550	20.0860	20.0528	19.6651	18.6828	17.4353	16.3725	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.4651	16.9559	17.6541	18.5409	19.3083	19.8550	20.0860	20.0528	19.6651	18.6828	17.4353	16.3725	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8445	0.8043	0.7556	0.6786	0.5796	0.4561	0.3421	0.3744	0.5371	0.7048	0.8064	0.8544	(94)
Useful gains	453.9716	509.5520	531.0338	527.6867	476.3984	369.3383	265.2432	272.1601	363.9434	422.8760	432.5127	436.8455	(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	1047.0442	1035.9163	956.8671	820.7030	646.7333	443.6855	294.3277	308.0212	471.0938	687.0749	881.1175	1040.9218	(97)
Space heating kWh	441.2460	353.7168	316.8200	210.9717	126.7292	0.0000	0.0000	0.0000	0.0000	196.5639	322.9954	449.4328	(98a)
Space heating requirement - total per year (kWh/year)												2418.4758	
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	441.2460	353.7168	316.8200	210.9717	126.7292	0.0000	0.0000	0.0000	0.0000	196.5639	322.9954	449.4328	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2418.4758	
Space heating per m2											(98c) / (4) =	39.6471	(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 %)	92.4000	(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	441.2460	353.7168	316.8200	210.9717	126.7292	0.0000	0.0000	0.0000	0.0000	196.5639	322.9954	449.4328	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	477.5390	382.8104	342.8787	228.3243	137.1528	0.0000	0.0000	0.0000	0.0000	212.7315	349.5621	486.3991	(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	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.9174	85.7219	85.3679	84.7622	83.7344	80.3000	80.3000	80.3000	80.3000	84.5808	85.5189	85.9726	(217)
Fuel for water heating, kWh/month	246.3006	218.4670	233.6286	208.4756	205.6155	194.4045	191.8535	199.8860	201.3836	211.8029	221.0216	243.6812	(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	2617.3981 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2576.5206 (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	4925.9342 (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	2617.3981	0.2100	549.6536	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2576.5206	0.2100	541.0693	(264)
Space and water heating			1090.7229	(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			1058.8155	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.3600	(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	2617.3981	1.1300	2957.6598	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2576.5206	1.1300	2911.4683	(278)
Space and water heating			5869.1281	(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			5684.5776	(286)
Target Primary Energy Rate (TPER)			93.1900	(287)

Full SAP Calculation Printout

Property Reference	Flat 102 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 102 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	16.03	TER	18.01
Environmental	89 B	% DER < TER			10.99
CO_2 Emissions (t/year)	0.74	DFEE	40.11	TFEE	44.41
Compliance Check	See BREL	% DFEE < TFEE			9.69
% DPER < TPER	5.11	DPER	91.92	TPER	96.87

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:													
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	50.9589	46.0274	50.9589	49.0216	48.8744	45.4446	46.2231	47.6592	47.5876	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(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	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(64)
									Total per year (kWh/year) = Sum(64)m =			2246.1496	(64)
12Total per year (kWh/year)												2246	(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	70.0674	61.9510	65.7396	57.5022	55.1486	49.0370	48.0316	50.4193	51.4612	58.0593	61.9797	69.2689	(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	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)												
	94.1766	92.1890	88.3596	79.8641	74.1244	68.1070	64.5586	67.7679	71.4739	78.0366	86.0829	93.1033 (72)
Total internal gains												
	374.1122	381.8817	365.9062	351.5253	332.5952	316.1207	303.3426	304.9802	315.1935	330.6416	351.8783	366.3558 (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	408.2232	451.3157	491.0042	556.9722	608.7561	610.5374	578.7635	524.5489	467.6274	415.4955	394.7988	394.2126 (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													
	0.9141	0.8860	0.8369	0.7295	0.5850	0.4289	0.3208	0.3651	0.5675	0.7807	0.8815	0.9205	(86)
MIT	19.2248	19.4856	19.8829	20.4002	20.7520	20.9282	20.9774	20.9668	20.8335	20.3724	19.7410	19.1883	(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													
	0.9047	0.8740	0.8198	0.7031	0.5479	0.3824	0.2666	0.3075	0.5176	0.7523	0.8671	0.9118	(89)
MIT 2	18.1109	18.4370	18.9300	19.5608	19.9657	20.1610	20.2060	20.2003	20.0685	19.5439	18.7687	18.0710	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	18.8158	19.1005	19.5330	20.0919	20.4632	20.6465	20.6942	20.6853	20.5526	20.0682	19.3839	18.7780	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6658	18.9505	19.3830	19.9419	20.3132	20.4965	20.5442	20.5353	20.4026	19.9182	19.2339	18.6280	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8832	0.8522	0.8003	0.6936	0.5530	0.3992	0.2893	0.3310	0.5299	0.7408	0.8465	0.8908	(94)
Useful gains	360.5517	384.5928	392.9329	386.3172	336.6127	243.7114	167.4603	173.6173	247.7797	307.8159	334.1974	351.1842	(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													
	645.4740	629.5135	575.5570	486.2545	378.2017	255.1437	170.6657	178.4104	274.3269	409.1538	535.8922	640.8970	(97)
Space heating kWh													
	211.9821	164.5867	135.8723	71.9549	30.9423	0.0000	0.0000	0.0000	0.0000	75.3954	145.2203	215.5463	(98a)
Space heating requirement - total per year (kWh/year)												1051.5002	
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													
	211.9821	164.5867	135.8723	71.9549	30.9423	0.0000	0.0000	0.0000	0.0000	75.3954	145.2203	215.5463	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1051.5002	
Space heating per m2										(98c) / (4) =		20.3661	(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 %)	89.5000 (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													
	211.9821	164.5867	135.8723	71.9549	30.9423	0.0000	0.0000	0.0000	0.0000	75.3954	145.2203	215.5463	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	236.8516	183.8957	151.8127	80.3965	34.5723	0.0000	0.0000	0.0000	0.0000	84.2406	162.2573	240.8339	(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												
	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714 (64)
Efficiency of water heater												89.5000 (216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (217)
Fuel for water heating, kWh/month												
	249.5786	220.9376	235.0357	206.8179	198.8682	177.3805	174.2177	182.6395	186.1207	209.2271	221.9454	246.8954 (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	20.9960	18.9641	20.9960	20.3187	20.9960	20.3187	20.9960	20.9960	20.3187	20.9960	20.3187	20.9960 (231)
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 (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	1174.8606 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2509.6644 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)	
mechanical ventilation fans (SFP = 0.9920)	161.2105 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	247.2105 (231)
Electricity for lighting (calculated in Appendix L)	135.8500 (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	4067.5855 (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	1174.8606	0.2100	246.7207	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2509.6644	0.2100	527.0295	(264)
Space and water heating			773.7502	(265)
Pumps, fans and electric keep-hot	247.2105	0.1387	34.2911	(267)
Energy for lighting	135.8500	0.1443	19.6074	(268)
Total CO2, kg/year			827.6487	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.0300	(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	1174.8606	1.1300	1327.5925	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2509.6644	1.1300	2835.9207	(278)
Space and water heating			4163.5132	(279)
Pumps, fans and electric keep-hot	247.2105	1.5128	373.9800	(281)
Energy for lighting	135.8500	1.5338	208.3713	(282)
Total Primary energy kWh/year			4745.8645	(286)
Dwelling Primary energy Rate (DPER)			91.9200	(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		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:													
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	50.9589	46.0274	50.9589	49.0216	48.8744	45.4446	46.2231	47.6592	47.5876	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(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													
	198.9777	176.1638	187.7646	166.3947	160.5524	143.8366	141.9407	148.5916	151.1423	169.0613	178.0262	197.0280	(64)
										Total per year (kWh/year) = Sum(64)m =		2019.4799	(64)
12Total per year (kWh/year)												2019	(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													
	70.0674	61.9510	65.7396	57.5022	55.1486	49.0370	48.0316	50.4193	51.4612	58.0593	61.9797	69.2689	(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													
	76.5233	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	0.0000	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)													
	94.1766	92.1890	88.3596	79.8641	74.1244	68.1070	64.5586	67.7679	71.4739	78.0366	86.0829	93.1033	(72)
Total internal gains													
	374.2383	382.0214	366.0323	351.6556	332.7213	316.2510	303.4687	305.1063	315.3238	330.7677	352.0086	366.4819	(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	412.2721	459.4402	505.5166	580.7288	640.6406	644.5255	610.5628	549.9253	485.2875	425.3797	399.8649	397.5422	(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	0.9403	0.9208	0.8854	0.8049	0.6828	0.5340	0.4155	0.4685	0.6738	0.8481	0.9190	0.9449	(86)
MIT	18.3763	18.6662	19.1598	19.8498	20.4218	20.7815	20.9159	20.8844	20.5882	19.8568	19.0192	18.3299	(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	0.9316	0.9094	0.8684	0.7757	0.6353	0.4634	0.3242	0.3744	0.6077	0.8185	0.9055	0.9369	(89)
MIT 2	16.8542	17.2190	17.8369	18.6851	19.3528	19.7429	19.8645	19.8444	19.5604	18.7165	17.6755	16.8004	(90)
Living area fraction										fLA = Living area / (4) =		0.6328	(91)
MIT	17.8173	18.1347	18.6740	19.4221	20.0293	20.4001	20.5298	20.5025	20.2108	19.4381	18.5258	17.7682	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8173	18.1347	18.6740	19.4221	20.0293	20.4001	20.5298	20.5025	20.2108	19.4381	18.5258	17.7682	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9103	0.8864	0.8457	0.7613	0.6412	0.4964	0.3774	0.4271	0.6274	0.8037	0.8839	0.9164	(94)
Useful gains	375.3031	407.2584	427.5374	442.0939	410.7770	319.9274	230.4298	234.8959	304.4772	341.8895	353.4562	364.3002	(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	866.5914	846.7073	777.2540	665.3219	525.7125	362.9764	245.9332	256.3331	383.6783	557.8252	723.8074	862.8271	(97)
Space heating kWh	365.5185	295.3097	260.1891	160.7242	85.5120	0.0000	0.0000	0.0000	0.0000	160.6562	266.6529	370.9040	(98a)
Space heating requirement - total per year (kWh/year)												1965.4666	
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	365.5185	295.3097	260.1891	160.7242	85.5120	0.0000	0.0000	0.0000	0.0000	160.6562	266.6529	370.9040	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1965.4666	
Space heating per m2											(98c) / (4) =	38.0683	(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 %)	92.4000	(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	365.5185	295.3097	260.1891	160.7242	85.5120	0.0000	0.0000	0.0000	0.0000	160.6562	266.6529	370.9040	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	395.5828	319.5992	281.5900	173.9439	92.5455	0.0000	0.0000	0.0000	0.0000	173.8703	288.5854	401.4113	(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	198.9777	176.1638	187.7646	166.3947	160.5524	143.8366	141.9407	148.5916	151.1423	169.0613	178.0262	197.0280	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.6660	85.4794	85.0806	84.3072	83.0935	80.3000	80.3000	80.3000	80.3000	84.2723	85.2450	85.7153	(217)
Fuel for water heating, kWh/month	232.2714	206.0893	220.6902	197.3672	193.2191	179.1241	176.7630	185.0456	188.2220	200.6132	208.8406	229.8633	(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												2127.1283	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2418.1090 (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	4334.2361 (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	2127.1283	0.2100	446.6969	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2418.1090	0.2100	507.8029	(264)
Space and water heating			954.4998	(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			929.6942	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.0100	(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	2127.1283	1.1300	2403.6550	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2418.1090	1.1300	2732.4632	(278)
Space and water heating			5136.1182	(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			5001.5671	(286)
Target Primary Energy Rate (TPER)			96.8700	(287)

Full SAP Calculation Printout

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

SAP Rating	82 B	DER	16.86	TER	18.32
Environmental	88 B	% DER < TER			7.97
CO_2 Emissions (t/year)	0.79	DFEE	42.84	TFEE	47.18
Compliance Check	See BREL	% DFEE < TFEE			9.21
% DPER < TPER	2.17	DPER	96.06	TPER	98.19

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

24.3680	24.0061	23.4965	22.5568	21.8532	21.0730	20.6516	21.1577	21.7087	22.5435	23.5025	24.2856	(42b)

Hot water usage for other uses

34.2550	33.0093	31.7637	30.5181	29.2724	28.0268	28.0268	29.2724	30.5181	31.7637	33.0093	34.2550	(42c)

Average daily hot water use (litres/day) 103.1012 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1687	109.7565	106.8286	102.3998	98.7948	94.9226	93.4517	96.3671	99.4394	103.5024	107.9987	111.8811	(44)
Energy conte	177.6478	156.2917	164.1916	140.1802	132.9969	116.7184	113.0218	119.3226	122.6188	140.4517	153.8640	175.1788	(45)

Energy content (annual) Total = Sum(45)m = 1712.4842

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

26.6472	23.4438	24.6287	21.0270	19.9495	17.5078	16.9533	17.8984	18.3928	21.0678	23.0796	26.2768	(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 50.9589	46.0274	50.9589	49.3151	50.3448	46.8112	47.6220	49.1076	49.0386	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

228.6067	202.3191	215.1505	189.4952	183.3416	163.5296	160.6437	168.4303	171.6574	191.4106	203.1791	226.1377	(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

228.6067	202.3191	215.1505	189.4952	183.3416	163.5296	160.6437	168.4303	171.6574	191.4106	203.1791	226.1377	(64)

Total per year (kWh/year) = Sum(64)m = 2303.9016 (64)
12Total per year (kWh/year) 2304 (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

71.8076	63.4738	67.3334	58.9387	56.8076	50.5117	49.4852	51.9517	53.0304	59.4399	63.4885	70.9867	(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	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)												
	96.5156	94.4551	90.5019	81.8593	76.3544	70.1551	66.5124	69.8275	73.6533	79.8924	88.1785	95.4122 (72)
Total internal gains												
	378.0590	385.8175	369.6412	355.0758	336.2969	319.5933	306.6624	308.3959	318.7702	333.9319	355.4921	370.2302 (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	516.6433	621.8779	692.6293	755.2738	784.5520	764.6069	735.7030	701.5837	668.4981	594.8290	521.4842	488.8295 (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												
	0.8363	0.7788	0.7138	0.6195	0.5108	0.3891	0.2918	0.3158	0.4600	0.6496	0.7849	0.8491 (86)
MIT	18.4897	18.9565	19.4845	20.0752	20.5205	20.8117	20.9267	20.9109	20.7146	20.1259	19.2285	18.4052 (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												
	0.8224	0.7614	0.6919	0.5910	0.4739	0.3421	0.2361	0.2592	0.4120	0.6168	0.7651	0.8361 (89)
MIT 2	17.1542	17.7253	18.3694	19.0825	19.6000	19.9263	20.0375	20.0267	19.8277	19.1616	18.0787	17.0542 (90)
Living area fraction									fLA = Living area / (4) =			0.6488 (91)
MIT	18.0207	18.5241	19.0929	19.7266	20.1973	20.5008	20.6145	20.6004	20.4032	19.7873	18.8247	17.9308 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8707	18.3741	18.9429	19.5766	20.0473	20.3508	20.4645	20.4504	20.2532	19.6373	18.6747	17.7808 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7832	0.7253	0.6627	0.5747	0.4727	0.3561	0.2596	0.2822	0.4213	0.5999	0.7304	0.7970	(94)
Useful gains	404.6498	451.0572	459.0126	434.0277	370.8864	272.2414	190.9905	197.9576	281.6430	356.8263	380.9050	389.6208	(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													
	727.4022	720.3773	663.5397	562.0270	438.2629	297.9958	200.2489	209.3282	320.5329	474.4908	610.8914	720.4912	(97)
Space heating kWh													
	240.1278	180.9831	152.1682	92.1595	50.1281	0.0000	0.0000	0.0000	0.0000	87.5424	165.5902	246.1676	(98a)
Space heating requirement - total per year (kWh/year)												1214.8667	
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													
	240.1278	180.9831	152.1682	92.1595	50.1281	0.0000	0.0000	0.0000	0.0000	87.5424	165.5902	246.1676	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1214.8667	
Space heating per m2											(98c) / (4) =	23.3628	(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 %)												89.5000 (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												
	240.1278	180.9831	152.1682	92.1595	50.1281	0.0000	0.0000	0.0000	0.0000	87.5424	165.5902	246.1676 (98)
Space heating efficiency (main heating system 1)												
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)												
	268.2992	202.2157	170.0203	102.9715	56.0090	0.0000	0.0000	0.0000	0.0000	97.8127	185.0170	275.0476 (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
228.6067 202.3191 215.1505 189.4952 183.3416 163.5296 160.6437 168.4303 171.6574 191.4106 203.1791 226.1377 (64)
Efficiency of water heater 89.5000 (216)
(217)m 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 (217)
Fuel for water heating, kWh/month
255.4264 226.0549 240.3916 211.7265 204.8510 182.7146 179.4902 188.1903 191.7960 213.8666 227.0157 252.6679 (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 20.1654 18.2139 20.1654 19.5149 20.1654 19.5149 20.1654 20.1654 19.5149 20.1654 19.5149 20.1654 (231)
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 (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 1357.3930 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.5000
Water heating fuel used 2574.1917 (219)
Space cooling fuel 0.0000 (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)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 237.4313 (231)
Electricity for lighting (calculated in Appendix L) 125.8946 (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 4294.9105 (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	1357.3930	0.2100	285.0525	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2574.1917	0.2100	540.5803	(264)
Space and water heating			825.6328	(265)
Pumps, fans and electric keep-hot	237.4313	0.1387	32.9346	(267)
Energy for lighting	125.8946	0.1443	18.1705	(268)
Total CO2, kg/year			876.7379	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.8600	(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	1357.3930	1.1300	1533.8541	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2574.1917	1.1300	2908.8366	(278)
Space and water heating			4442.6907	(279)
Pumps, fans and electric keep-hot	237.4313	1.5128	359.1860	(281)
Energy for lighting	125.8946	1.5338	193.1013	(282)
Total Primary energy kWh/year			4994.9780	(286)
Dwelling Primary energy Rate (DPER)			96.0600	(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	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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1528	383.9955	367.9118	353.5288	334.4898	317.9530	305.0986	306.7373	317.0101	332.4537	353.8072	368.3504	(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	499.9567	594.8792	656.4521	711.0443	734.9369	715.5043	688.3805	657.9903	629.4383	565.5252	502.0956	474.3007 (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	0.8869	0.8474	0.8004	0.7267	0.6309	0.5096	0.3987	0.4268	0.5807	0.7493	0.8513	0.8959	(86)
MIT	17.6557	18.1095	18.7081	19.4474	20.0970	20.5880	20.8196	20.7868	20.4310	19.5819	18.4968	17.5692	(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	0.8735	0.8299	0.7771	0.6934	0.5824	0.4384	0.3049	0.3335	0.5131	0.7116	0.8312	0.8835	(89)
MIT 2	15.9861	16.5400	17.2704	18.1617	18.9182	19.4578	19.6763	19.6526	19.3044	18.3450	17.0332	15.8824	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.0694	17.5583	18.2033	18.9959	19.6831	20.1911	20.4181	20.3885	20.0354	19.1476	17.9828	16.9769	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0694	17.5583	18.2033	18.9959	19.6831	20.1911	20.4181	20.3885	20.0354	19.1476	17.9828	16.9769	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8351	0.7911	0.7420	0.6696	0.5787	0.4638	0.3559	0.3820	0.5286	0.6895	0.7946	0.8459	(94)
Useful gains	417.5291	470.6182	487.1008	476.1234	425.2831	331.8478	244.9646	251.3538	332.6975	389.9132	398.9897	401.2062	(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	937.4758	927.6016	856.0556	732.1626	578.0024	401.7684	274.3647	286.2067	427.7523	618.8732	790.5324	931.2843	(97)
Space heating kWh	386.8403	307.0928	274.5024	184.3482	113.6232	0.0000	0.0000	0.0000	0.0000	170.3463	281.9107	394.3781	(98a)
Space heating requirement - total per year (kWh/year)												2113.0420	
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	386.8403	307.0928	274.5024	184.3482	113.6232	0.0000	0.0000	0.0000	0.0000	170.3463	281.9107	394.3781	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2113.0420	
Space heating per m2											(98c) / (4) =	40.6354	(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 %) 92.4000 (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	386.8403	307.0928	274.5024	184.3482	113.6232	0.0000	0.0000	0.0000	0.0000	170.3463	281.9107	394.3781	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	418.6584	332.3515	297.0805	199.5110	122.9688	0.0000	0.0000	0.0000	0.0000	184.3575	305.0982	426.8161	(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	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.7745	85.5545	85.1887	84.5942	83.6467	80.3000	80.3000	80.3000	80.3000	84.3925	85.3563	85.8323	(217)
Fuel for water heating, kWh/month	232.5697	206.4303	220.9612	197.3724	192.5998	179.7386	177.3695	185.6805	188.8679	200.8074	209.0858	230.1338	(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												2286.8420	(211)

Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2421.6171 (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	4409.6184 (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	2286.8420	0.2100	480.2368	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2421.6171	0.2100	508.5396	(264)
Space and water heating			988.7764	(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			952.6153	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.3200	(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	2286.8420	1.1300	2584.1315	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2421.6171	1.1300	2736.4273	(278)
Space and water heating			5320.5588	(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			5106.0734	(286)
Target Primary Energy Rate (TPER)			98.1900	(287)

Full SAP Calculation Printout

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

SAP Rating	83 B	DER	15.89	TER	17.83
Environmental	89 B	% DER < TER			10.88
CO_2 Emissions (t/year)	0.73	DFEE	39.39	TFEE	43.62
Compliance Check	See BREL	% DFEE < TFEE			9.70
% DPER < TPER	4.97	DPER	91.14	TPER	95.91

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:													
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	50.9589	46.0274	50.9589	49.0216	48.8744	45.4446	46.2231	47.6592	47.5876	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(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	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(64)
									Total per year (kWh/year) = Sum(64)m =			2246.1496	(64)
12Total per year (kWh/year)												2246	(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	70.0674	61.9510	65.7396	57.5022	55.1486	49.0370	48.0316	50.4193	51.4612	58.0593	61.9797	69.2689	(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	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)													
	94.1766	92.1890	88.3596	79.8641	74.1244	68.1070	64.5586	67.7679	71.4739	78.0366	86.0829	93.1033	(72)
Total internal gains													
	374.1122	381.8817	365.9062	351.5253	332.5952	316.1207	303.3426	304.9802	315.1935	330.6416	351.8783	366.3558	(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	419.7397	469.2407	511.0361	574.2602	621.2449	619.9117	589.0598	538.8880	486.7823	434.0947	408.2848	404.2677	(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													
	0.9089	0.8770	0.8250	0.7177	0.5765	0.4233	0.3155	0.3562	0.5507	0.7652	0.8734	0.9161	(86)
MIT	19.2642	19.5404	19.9333	20.4278	20.7616	20.9307	20.9784	20.9690	20.8465	20.4093	19.7817	19.2237	(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													
	0.8991	0.8643	0.8072	0.6909	0.5395	0.3772	0.2621	0.2997	0.5013	0.7359	0.8584	0.9070	(89)
MIT 2	18.1597	18.5041	18.9903	19.5921	19.9756	20.1632	20.2067	20.2018	20.0806	19.5858	18.8181	18.1148	(90)
Living area fraction										fLA = Living area / (4) =		0.6328	(91)
MIT	18.8586	19.1599	19.5870	20.1209	20.4730	20.6489	20.6950	20.6872	20.5652	20.1069	19.4278	18.8165	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7086	19.0099	19.4370	19.9709	20.3230	20.4989	20.5450	20.5372	20.4152	19.9569	19.2778	18.6665	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8774	0.8425	0.7883	0.6824	0.5450	0.3939	0.2846	0.3229	0.5143	0.7257	0.8379	0.8858	(94)
Useful gains	368.2861	395.3430	402.8544	391.8483	338.5809	244.2080	167.6386	174.0078	250.3315	315.0308	342.1180	358.1092	(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													
	647.3970	632.1722	577.9728	487.5308	378.6289	255.2465	170.7031	178.4923	274.8778	410.8544	537.8314	642.6052	(97)
Space heating kWh													
	207.6585	159.1492	130.2881	68.8914	29.7957	0.0000	0.0000	0.0000	0.0000	71.2928	140.9137	211.6650	(98a)
Space heating requirement - total per year (kWh/year)												1019.6544	
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													
	207.6585	159.1492	130.2881	68.8914	29.7957	0.0000	0.0000	0.0000	0.0000	71.2928	140.9137	211.6650	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1019.6544	
Space heating per m2											(98c) / (4) =	19.7493	(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 %)												89.5000	(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													
	207.6585	159.1492	130.2881	68.8914	29.7957	0.0000	0.0000	0.0000	0.0000	71.2928	140.9137	211.6650	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	232.0206	177.8203	145.5733	76.9737	33.2912	0.0000	0.0000	0.0000	0.0000	79.6568	157.4454	236.4973	(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

223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714 (64)
Efficiency of water heater											89.5000 (216)
(217)m 89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (217)
Fuel for water heating, kWh/month											
249.5786	220.9376	235.0357	206.8179	198.8682	177.3805	174.2177	182.6395	186.1207	209.2271	221.9454	246.8954 (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 20.9960	18.9641	20.9960	20.3187	20.9960	20.3187	20.9960	20.9960	20.3187	20.9960	20.3187	20.9960 (231)
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 (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	1139.2787 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2509.6644 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)	
mechanical ventilation fans (SFP = 0.9920)	161.2105 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	247.2105 (231)
Electricity for lighting (calculated in Appendix L)	135.8500 (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	4032.0035 (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	1139.2787	0.2100	239.2485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2509.6644	0.2100	527.0295	(264)
Space and water heating			766.2780	(265)
Pumps, fans and electric keep-hot	247.2105	0.1387	34.2911	(267)
Energy for lighting	135.8500	0.1443	19.6074	(268)
Total CO2, kg/year			820.1765	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.8900	(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	1139.2787	1.1300	1287.3849	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2509.6644	1.1300	2835.9207	(278)
Space and water heating			4123.3056	(279)
Pumps, fans and electric keep-hot	247.2105	1.5128	373.9800	(281)
Energy for lighting	135.8500	1.5338	208.3713	(282)
Total Primary energy kWh/year			4705.6569	(286)
Dwelling Primary energy Rate (DPER)			91.1400	(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		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	

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:													
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	50.9589	46.0274	50.9589	49.0216	48.8744	45.4446	46.2231	47.6592	47.5876	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.3729	197.7391	210.3570	185.1021	177.9871	158.7556	155.9248	163.4623	166.5780	187.2582	198.6411	220.9714	(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													
	198.9777	176.1638	187.7646	166.3947	160.5524	143.8366	141.9407	148.5916	151.1423	169.0613	178.0262	197.0280	(64)
										Total per year (kWh/year) = Sum(64)m =		2019.4799	(64)
12Total per year (kWh/year)												2019	(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													
	70.0674	61.9510	65.7396	57.5022	55.1486	49.0370	48.0316	50.4193	51.4612	58.0593	61.9797	69.2689	(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	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	0.0000	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)													
	94.1766	92.1890	88.3596	79.8641	74.1244	68.1070	64.5586	67.7679	71.4739	78.0366	86.0829	93.1033	(72)
Total internal gains													
	374.2383	382.0214	366.0323	351.6556	332.7213	316.2510	303.4687	305.1063	315.3238	330.7677	352.0086	366.4819	(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	9.3800	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	425.1362	479.4628	527.8926	600.0399	654.5908	654.9968	622.0641	565.9424	506.6840	446.1555	414.9291	408.7740	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.2347	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	0.9366	0.9141	0.8764	0.7951	0.6748	0.5278	0.4091	0.4580	0.6575	0.8359	0.9132	0.9418	(86)
MIT	18.4166	18.7248	19.2177	19.8872	20.4384	20.7874	20.9189	20.8904	20.6121	19.9039	19.0632	18.3658	(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	0.9274	0.9020	0.8584	0.7651	0.6270	0.4575	0.3188	0.3651	0.5908	0.8048	0.8988	0.9334	(89)
MIT 2	16.9045	17.2913	17.9068	18.7279	19.3699	19.7478	19.8663	19.8482	19.5827	18.7705	17.7295	16.8452	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	17.8613	18.1984	18.7363	19.4615	20.0460	20.4056	20.5324	20.5076	20.2341	19.4877	18.5734	17.8074	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8613	18.1984	18.7363	19.4615	20.0460	20.4056	20.5324	20.5076	20.2341	19.4877	18.5734	17.8074	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9057	0.8786	0.8359	0.7516	0.6337	0.4907	0.3715	0.4175	0.6122	0.7911	0.8771	0.9124	(94)
Useful gains	385.0269	421.2666	441.2846	451.0159	414.8091	321.3752	231.1267	236.2892	310.1763	352.9402	363.9174	372.9482	(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	869.4126	850.7797	781.2326	667.8155	526.7664	363.3220	246.0913	256.6545	385.1411	560.9547	726.8277	865.3197	(97)
Space heating kWh	360.3829	288.6328	252.9213	156.0957	83.2962	0.0000	0.0000	0.0000	0.0000	154.7628	261.2954	366.3244	(98a)
Space heating requirement - total per year (kWh/year)												1923.7116	
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	360.3829	288.6328	252.9213	156.0957	83.2962	0.0000	0.0000	0.0000	0.0000	154.7628	261.2954	366.3244	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1923.7116	
Space heating per m2										(98c) / (4) =		37.2596	(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 %)	92.4000	(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	360.3829	288.6328	252.9213	156.0957	83.2962	0.0000	0.0000	0.0000	0.0000	154.7628	261.2954	366.3244	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	390.0248	312.3731	273.7244	168.9347	90.1474	0.0000	0.0000	0.0000	0.0000	167.4922	282.7872	396.4550	(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	198.9777	176.1638	187.7646	166.3947	160.5524	143.8366	141.9407	148.5916	151.1423	169.0613	178.0262	197.0280	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.6374	85.4322	85.0204	84.2447	83.0442	80.3000	80.3000	80.3000	80.3000	84.1925	85.2023	85.6903	(217)
Fuel for water heating, kWh/month	232.3490	206.2032	220.8466	197.5135	193.3338	179.1241	176.7630	185.0456	188.2220	200.8032	208.9453	229.9303	(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												2081.9389	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2419.0796	(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	4290.0173	(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	2081.9389	0.2100	437.2072	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2419.0796	0.2100	508.0067	(264)
Space and water heating			945.2139	(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			920.4082	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.8300	(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	2081.9389	1.1300	2352.5910	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2419.0796	1.1300	2733.5600	(278)
Space and water heating			5086.1510	(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			4951.5999	(286)
Target Primary Energy Rate (TPER)			95.9100	(287)

Full SAP Calculation Printout

Property Reference	Flat 103 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 103 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	83 B	DER	14.41	TER	15.98
Environmental	88 B	% DER < TER			9.82
CO_2 Emissions (t/year)	0.94	DFEE	40.70	TFEE	44.50
Compliance Check	See BREL	% DFEE < TFEE			8.54
% DPER < TPER	2.93	DPER	83.09	TPER	85.60

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)

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) =	4696.5600 (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	28.6762	28.2504	27.6506	26.5448	25.7168	24.7987	24.3028	24.8983	25.5467	26.5292	27.6577	28.5793	(42b)
Hot water usage for other uses	40.3740	38.9059	37.4377	35.9696	34.5014	33.0333	33.0333	34.5014	35.9696	37.4377	38.9059	40.3740	(42c)
Average daily hot water use (litres/day)												121.4331	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.1134	129.2716	125.8227	120.6065	116.3604	111.7995	110.0676	113.5018	117.1208	121.9062	127.2020	131.7748	(44)
Energy conte	209.2353	184.0811	193.3849	165.1043	156.6434	137.4706	133.1172	140.5390	144.4216	165.4255	181.2225	206.3275	(45)
Energy content (annual)										Total = Sum(45)m =		2016.9729	
Distribution loss (46)m = 0.15 x (45)m	31.3853	27.6122	29.0077	24.7656	23.4965	20.6206	19.9676	21.0808	21.6632	24.8138	27.1834	30.9491	(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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	260.1942	230.1085	244.3438	214.4193	207.6023	186.7856	184.0761	191.4979	193.7367	216.3844	230.5376	257.2864	(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	260.1942	230.1085	244.3438	214.4193	207.6023	186.7856	184.0761	191.4979	193.7367	216.3844	230.5376	257.2864	(64)
										Total per year (kWh/year) = Sum(64)m =		2616.9729	(64)
12Total per year (kWh/year)												2617	(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	82.3105	72.7138	77.0402	67.2259	64.8237	58.0377	57.0012	59.4689	60.3490	67.7437	72.5853	81.3436	(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	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	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)

	110.6323	108.2051	103.5487	93.3694	87.1286	80.6080	76.6145	79.9314	83.8180	91.0534	100.8129	109.3328 (72)

Total internal gains

	478.5711	489.2977	468.2667	450.1532	426.1301	406.5563	390.1201	391.3181	403.9774	422.1470	449.6888	468.2619 (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	631.0979	756.3019	852.7039	958.5213	1024.7819	1013.7395	970.1576	902.0337	831.0233	722.3963	633.6910	597.9453 (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	0.8649	0.8120	0.7451	0.6387	0.5152	0.3844	0.2876	0.3188	0.4802	0.6853	0.8180	0.8763	(86)
MIT	18.6355	19.0741	19.5970	20.1913	20.6120	20.8606	20.9483	20.9331	20.7559	20.1889	19.3327	18.5612	(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	0.8531	0.7967	0.7251	0.6117	0.4802	0.3407	0.2364	0.2657	0.4340	0.6547	0.8007	0.8654	(89)
MIT 2	17.3612	17.9040	18.5475	19.2697	19.7595	20.0396	20.1245	20.1145	19.9338	19.2867	18.2427	17.2739	(90)
Living area fraction										fLA = Living area / (4) =		0.5347	(91)
MIT	18.0425	18.5296	19.1087	19.7625	20.2153	20.4785	20.5650	20.5522	20.3734	19.7691	18.8255	17.9622	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8925	18.3796	18.9587	19.6125	20.0653	20.3285	20.4150	20.4022	20.2234	19.6191	18.6755	17.8122	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8155	0.7605	0.6944	0.5936	0.4766	0.3497	0.2522	0.2812	0.4379	0.6339	0.7655	0.8284	(94)
Useful gains	514.6763	575.1581	592.1112	568.9527	488.4462	354.5329	244.6853	253.6720	363.9061	457.9021	485.1033	495.3527	(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	936.0854	925.7136	853.2012	723.3043	563.2119	380.1727	253.1814	264.8345	408.7327	607.2307	783.8048	926.9557	(97)
Space heating kWh	313.5283	235.5733	194.2510	111.1331	55.6257	0.0000	0.0000	0.0000	0.0000	111.1004	215.0650	321.1127	(98a)
Space heating requirement - total per year (kWh/year)												1557.3895	
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	313.5283	235.5733	194.2510	111.1331	55.6257	0.0000	0.0000	0.0000	0.0000	111.1004	215.0650	321.1127	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1557.3895	
Space heating per m2											(98c) / (4) =	21.3341	(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	0.8693	0.9060	0.8890	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	542.2841	444.9159	447.0706	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1136.7640	1088.1953	1009.7411	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	428.0255	478.5999	418.6268	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	107.0064	119.6500	104.6567	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												331.3131 (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 %)	89.5000 (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)	4.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	313.5283	235.5733	194.2510	111.1331	55.6257	0.0000	0.0000	0.0000	0.0000	111.1004	215.0650	321.1127	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	350.3110	263.2103	217.0402	124.1711	62.1516	0.0000	0.0000	0.0000	0.0000	124.1346	240.2961	358.7851	(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													
	260.1942	230.1085	244.3438	214.4193	207.6023	186.7856	184.0761	191.4979	193.7367	216.3844	230.5376	257.2864	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month													
	290.7198	257.1044	273.0098	239.5747	231.9579	208.6990	205.6716	213.9641	216.4656	241.7703	257.5839	287.4709	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	24.8852	27.8256	24.3388	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	25.3594	22.9052	25.3594	24.5413	25.3594	24.5413	25.3594	25.3594	24.5413	25.3594	24.5413	25.3594	(231)
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	(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	1740.1000 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2923.9920 (219)
Space cooling fuel	77.0495 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	212.5862 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	298.5862 (231)
Electricity for lighting (calculated in Appendix L)	152.7057 (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	5192.4335 (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	1740.1000	0.2100	365.4210	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2923.9920	0.2100	614.0383	(264)
Space and water heating			979.4593	(265)

Space cooling	77.0495	0.1142	8.8008 (266)
Pumps, fans and electric keep-hot	298.5862	0.1387	41.4176 (267)
Energy for lighting	152.7057	0.1443	22.0402 (268)
Total CO2, kg/year			1051.7179 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.4100 (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	1740.1000	1.1300	1966.3130 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2923.9920	1.1300	3304.1110 (278)
Space and water heating			5270.4240 (279)
Space cooling	77.0495	1.4210	109.4843 (280)
Pumps, fans and electric keep-hot	298.5862	1.5128	451.7012 (281)
Energy for lighting	152.7057	1.5338	234.2251 (282)
Total Primary energy kWh/year			6065.8347 (286)
Dwelling Primary energy Rate (DPER)			83.0900 (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	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	94.1243	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:												
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	254.7263	225.3270	239.3419	210.1404	203.5491	183.2301	180.6089	187.8204	189.9439	212.0443	225.7960	251.8882 (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	225.8964	199.8297	212.6425	188.0323	182.9451	165.5991	164.0827	170.2464	171.7022	190.5394	201.4335	223.5923 (64)

Total per year (kWh/year) = Sum(64)m = 2296.5418 (64)

12Total per year (kWh/year) 2297 (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	80.4924	71.1240	75.3771	65.8032	63.4760	56.8555	55.8484	58.2462	59.0879	66.3006	71.0087	79.5487 (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)

108.1887	105.8392	101.3133	91.3933	85.3171	78.9660	75.0650	78.2879	82.0665	89.1137	98.6232	106.9203 (72)

Total internal gains

476.1294	486.9340	466.0333	448.1792	424.3207	404.9164	388.5727	389.6766	402.2280	420.2094	447.5012	465.8514 (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	1.1500	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	614.5280	729.2065	814.8621	909.4610	967.5250	955.8623	914.8869	853.0889	789.7192	692.6477	614.4597	583.5224 (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	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	0.9085	0.8736	0.8274	0.7474	0.6410	0.5109	0.3990	0.4359	0.6063	0.7821	0.8774	0.9163	(86)
MIT	17.7633	18.1921	18.7886	19.5452	20.1903	20.6491	20.8506	20.8152	20.4667	19.6214	18.5705	17.6872	(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	0.8973	0.8587	0.8066	0.7163	0.5944	0.4427	0.3098	0.3460	0.5414	0.7481	0.8604	0.9060	(89)
MIT 2	16.1242	16.6547	17.3910	18.3118	19.0677	19.5747	19.7661	19.7409	19.3968	18.4282	17.1406	16.0324	(90)
Living area fraction									fLA = Living area / (4) =			0.5347	(91)
MIT	17.0006	17.4767	18.1382	18.9712	19.6679	20.1491	20.3459	20.3153	19.9688	19.0662	17.9051	16.9172	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0006	17.4767	18.1382	18.9712	19.6679	20.1491	20.3459	20.3153	19.9688	19.0662	17.9051	16.9172	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8608	0.8201	0.7699	0.6894	0.5867	0.4613	0.3497	0.3839	0.5487	0.7210	0.8236	0.8706	(94)
Useful gains	528.9910	598.0261	627.3334	626.9813	567.6106	440.9251	319.9246	327.4632	433.3446	499.3675	506.0763	508.0371	(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	1220.6540	1206.2276	1113.9358	954.6622	753.9136	520.5923	351.4245	366.7285	552.4001	801.0552	1026.1377	1212.3611	(97)
Space heating kWh	514.5973	408.7114	362.0322	235.9303	138.6094	0.0000	0.0000	0.0000	0.0000	224.4557	374.4442	524.0170	(98a)
Space heating requirement - total per year (kWh/year)												2782.7974	
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	514.5973	408.7114	362.0322	235.9303	138.6094	0.0000	0.0000	0.0000	0.0000	224.4557	374.4442	524.0170	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2782.7974	
Space heating per m2											(98c) / (4) =	38.1205	(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 %) 92.4000 (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	514.5973	408.7114	362.0322	235.9303	138.6094	0.0000	0.0000	0.0000	0.0000	224.4557	374.4442	524.0170	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	556.9234	442.3284	391.8097	255.3358	150.0102	0.0000	0.0000	0.0000	0.0000	242.9174	405.2426	567.1180	(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												
	225.8964	199.8297	212.6425	188.0323	182.9451	165.5991	164.0827	170.2464	171.7022	190.5394	201.4335	223.5923 (64)
Efficiency of water heater												80.3000 (216)
(217)m	86.0874	85.8797	85.5113	84.8688	83.7942	80.3000	80.3000	80.3000	80.3000	84.7334	85.6899	86.1409 (217)
Fuel for water heating, kWh/month												
	262.4037	232.6855	248.6719	221.5564	218.3267	206.2256	204.3372	212.0130	213.8260	224.8692	235.0726	259.5659 (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	3011.6855 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2739.5535 (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	5408.5840 (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	3011.6855	0.2100	632.4540	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2739.5535	0.2100	575.3062	(264)
Space and water heating			1207.7602	(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			1166.5162	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.9800	(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	3011.6855	1.1300	3403.2047	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2739.5535	1.1300	3095.6954	(278)
Space and water heating			6498.9001	(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			6248.7112	(286)
Target Primary Energy Rate (TPER)			85.6000	(287)

Full SAP Calculation Printout

Property Reference	Flat 104 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 104 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	16.25	TER	17.74
Environmental	89 B	% DER < TER			8.40
CO_2 Emissions (t/year)	0.76	DFEE	41.22	TFEE	44.54
Compliance Check	See BREL	% DFEE < TFEE			7.46
% DPER < TPER	2.06	DPER	93.10	TPER	95.06

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)			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:
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 50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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

223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(64)

Total per year (kWh/year) = Sum(64)m = 2252.8297 (64)
12Total per year (kWh/year) 2253 (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

70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	375.9843	383.8089	367.7433	353.3547	334.3213	317.7789	304.9301	306.5688	316.8360	332.2852	353.6331	368.1820	(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	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	434.0496	493.9774	548.3944	627.3302	686.9622	688.0004	653.4857	593.3588	529.3198	462.1104	425.2327	416.5466	(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	25.5911	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													
	0.9043	0.8688	0.8118	0.6995	0.5572	0.4089	0.3056	0.3471	0.5393	0.7557	0.8680	0.9121	(86)
MIT	19.0559	19.3714	19.8155	20.3606	20.7284	20.9165	20.9724	20.9606	20.8174	20.3242	19.6220	19.0067	(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													
	0.8940	0.8553	0.7928	0.6714	0.5192	0.3617	0.2507	0.2888	0.4882	0.7252	0.8523	0.9026	(89)
MIT 2	17.8697	18.2624	18.8109	19.4717	19.8932	20.1006	20.1517	20.1451	20.0046	19.4473	18.5891	17.8138	(90)
Living area fraction									fLA = Living area / (4) =			0.5727	(91)
MIT	18.5490	18.8975	19.3863	19.9808	20.3715	20.5679	20.6217	20.6121	20.4701	19.9495	19.1806	18.4970	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3990	18.7475	19.2363	19.8308	20.2215	20.4179	20.4717	20.4621	20.3201	19.7995	19.0306	18.3470	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8683	0.8294	0.7701	0.6598	0.5221	0.3761	0.2709	0.3096	0.4981	0.7108	0.8276	0.8775	(94)
Useful gains	376.8899	409.7076	422.2940	413.9398	358.6905	258.7566	177.0610	183.7019	263.6453	328.4792	351.9058	365.5271	(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													
	682.0733	668.1240	612.8682	518.9558	403.4750	271.7220	180.8283	189.1967	292.1065	435.5768	567.9621	677.1113	(97)
Space heating kWh													
	227.0565	173.6558	141.7872	75.6115	33.3197	0.0000	0.0000	0.0000	0.0000	79.6806	155.5605	231.8187	(98a)
Space heating requirement - total per year (kWh/year)												1118.4905	
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													
	227.0565	173.6558	141.7872	75.6115	33.3197	0.0000	0.0000	0.0000	0.0000	79.6806	155.5605	231.8187	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1118.4905	
Space heating per m2											(98c) / (4) =	21.5094	(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 %)												89.5000	(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													
	227.0565	173.6558	141.7872	75.6115	33.3197	0.0000	0.0000	0.0000	0.0000	79.6806	155.5605	231.8187	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	253.6944	194.0288	158.4215	84.4821	37.2287	0.0000	0.0000	0.0000	0.0000	89.0286	173.8106	259.0153	(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
223.9644 198.2597 210.9038 185.7371 178.5977 159.3002 156.4598 164.0232 167.1496 187.7259 199.1535 221.5547 (64)
Efficiency of water heater
89.5000 (216)
(217)m 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 (217)
Fuel for water heating, kWh/month
250.2396 221.5192 235.6468 207.5275 199.5505 177.9891 174.8154 183.2661 186.7593 209.7496 222.5179 247.5472 (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 21.0941 19.0527 21.0941 20.4136 21.0941 20.4136 21.0941 21.0941 20.4136 21.0941 20.4136 21.0941 (231)
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 (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 1249.7100 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.5000
Water heating fuel used 2517.1282 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)
mechanical ventilation fans (SFP = 0.9920) 162.3658 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 248.3658 (231)
Electricity for lighting (calculated in Appendix L) 136.3368 (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 4151.5407 (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	1249.7100	0.2100	262.4391	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2517.1282	0.2100	528.5969	(264)
Space and water heating			791.0360	(265)
Pumps, fans and electric keep-hot	248.3658	0.1387	34.4514	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			845.1650	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.2500	(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	1249.7100	1.1300	1412.1723	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2517.1282	1.1300	2844.3548	(278)
Space and water heating			4256.5271	(279)
Pumps, fans and electric keep-hot	248.3658	1.5128	375.7278	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			4841.3728	(286)
Dwelling Primary energy Rate (DPER)			93.1000	(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	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	

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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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1148	383.9534	367.8738	353.4895	334.4518	317.9137	305.0606	306.6993	316.9709	332.4157	353.7679	368.3124	(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	429.9049	486.0120	535.2300	607.3068	661.1500	660.9006	627.9748	572.3896	513.8186	452.6850	420.0962	413.1160	(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													
	0.9335	0.9105	0.8727	0.7929	0.6757	0.5318	0.4140	0.4619	0.6573	0.8324	0.9097	0.9388	(86)
MIT	18.2864	18.6046	19.1131	19.8040	20.3818	20.7581	20.9050	20.8736	20.5736	19.8319	18.9578	18.2331	(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													
	0.9240	0.8980	0.8544	0.7627	0.6277	0.4606	0.3216	0.3673	0.5903	0.8009	0.8950	0.9301	(89)
MIT 2	16.7330	17.1323	17.7674	18.6155	19.2908	19.7003	19.8342	19.8138	19.5254	18.6723	17.5893	16.6705	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	17.6226	17.9755	18.5381	19.2961	19.9157	20.3061	20.4474	20.4207	20.1257	19.3364	18.3730	17.5654	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6226	17.9755	18.5381	19.2961	19.9157	20.3061	20.4474	20.4207	20.1257	19.3364	18.3730	17.5654	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8993	0.8714	0.8283	0.7450	0.6295	0.4887	0.3695	0.4144	0.6060	0.7830	0.8699	0.9062	(94)
Useful gains	386.6045	423.5011	443.3398	452.4513	416.1709	322.9579	232.0648	237.1837	311.3856	354.4434	365.4449	374.3781	(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													
	881.2813	863.1895	793.1239	678.5475	535.2840	368.7159	248.6149	259.4139	390.6136	569.2146	737.1109	877.1790	(97)
Space heating kWh													
	368.0395	295.4706	260.2394	162.7893	88.6202	0.0000	0.0000	0.0000	0.0000	159.7897	267.5996	374.0838	(98a)
Space heating requirement - total per year (kWh/year)												1976.6320	
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													
	368.0395	295.4706	260.2394	162.7893	88.6202	0.0000	0.0000	0.0000	0.0000	159.7897	267.5996	374.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1976.6320	
Space heating per m2											(98c) / (4) =	38.0122	(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 %)												92.4000	(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													
	368.0395	295.4706	260.2394	162.7893	88.6202	0.0000	0.0000	0.0000	0.0000	159.7897	267.5996	374.0838	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	398.3112	319.7733	281.6443	176.1789	95.9093	0.0000	0.0000	0.0000	0.0000	172.9326	289.6099	404.8526	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.6748	85.4753	85.0757	84.3272	83.1547	80.3000	80.3000	80.3000	80.3000	84.2556	85.2472	85.7273	(217)
Fuel for water heating, kWh/month													
	232.8406	206.6215	221.2546	197.9974	193.7393	179.7386	177.3695	185.6805	188.8679	201.1339	209.3532	230.4158	(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	2139.2121 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2425.0128 (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	4265.3205 (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	2139.2121	0.2100	449.2345 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2425.0128	0.2100	509.2527 (264)
Space and water heating			958.4872 (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			922.3170 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.7400 (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	2139.2121	1.1300	2417.3097 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2425.0128	1.1300	2740.2645 (278)
Space and water heating			5157.5742 (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			4942.9931 (286)
Target Primary Energy Rate (TPER)			95.0600 (287)

Full SAP Calculation Printout

Property Reference	Flat 105 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 105 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	17.12	TER	18.99
Environmental	88 B	% DER < TER			9.85
CO_2 Emissions (t/year)	0.79	DFEE	45.29	TFEE	50.17
Compliance Check	See BREL	% DFEE < TFEE			9.73
% DPER < TPER	3.99	DPER	97.74	TPER	101.80

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

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
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:

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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(64)

Total per year (kWh/year) = Sum(64)m = 2252.8297 (64)
12Total per year (kWh/year) 2253 (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

70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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	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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	375.9843	383.8089	367.7433	353.3547	334.3213	317.7789	304.9301	306.5688	316.8360	332.2852	353.6331	368.1820	(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	458.4556	535.4645	604.9319	697.0025	764.6538	764.9774	727.7633	661.6771	590.4099	507.9013	454.4500	437.4432	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.2067	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													
	0.9041	0.8644	0.8037	0.6916	0.5525	0.4087	0.3063	0.3470	0.5346	0.7503	0.8671	0.9127	(86)
MIT	18.8260	19.1919	19.6860	20.2736	20.6788	20.8945	20.9634	20.9488	20.7827	20.2325	19.4464	18.7640	(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													
	0.8932	0.8497	0.7829	0.6611	0.5113	0.3568	0.2456	0.2827	0.4790	0.7171	0.8502	0.9026	(89)
MIT 2	17.5234	17.9776	18.5858	19.2947	19.7565	19.9910	20.0531	20.0449	19.8851	19.2681	18.3102	17.4513	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	18.3318	18.7311	19.2686	19.9022	20.3289	20.5517	20.6180	20.6058	20.4421	19.8666	19.0153	18.2659	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1818	18.5811	19.1186	19.7522	20.1789	20.4017	20.4680	20.4558	20.2921	19.7166	18.8653	18.1159	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8663	0.8226	0.7596	0.6502	0.5165	0.3755	0.2717	0.3096	0.4928	0.7034	0.8245	0.8764	(94)
Useful gains	397.1594	440.4510	459.5097	453.1874	394.9385	287.2754	197.7667	204.8444	290.9528	357.2497	374.6749	383.3862	(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													
	752.3063	739.6723	680.6017	578.3452	450.7737	304.7124	203.1528	212.4958	326.8094	484.6796	628.5229	746.9955	(97)
Space heating kWh													
	264.2292	201.0767	164.4925	90.1136	41.5414	0.0000	0.0000	0.0000	0.0000	94.8079	182.7706	270.5253	(98a)
Space heating requirement - total per year (kWh/year)												1309.5573	
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													
	264.2292	201.0767	164.4925	90.1136	41.5414	0.0000	0.0000	0.0000	0.0000	94.8079	182.7706	270.5253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1309.5573	
Space heating per m2											(98c) / (4) =	25.1838	(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 %)												89.5000	(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													
	264.2292	201.0767	164.4925	90.1136	41.5414	0.0000	0.0000	0.0000	0.0000	94.8079	182.7706	270.5253	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	295.2282	224.6667	183.7905	100.6856	46.4150	0.0000	0.0000	0.0000	0.0000	105.9306	204.2130	302.2629	(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
223.9644 198.2597 210.9038 185.7371 178.5977 159.3002 156.4598 164.0232 167.1496 187.7259 199.1535 221.5547 (64)
Efficiency of water heater 89.5000 (216)
(217)m 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 (217)
Fuel for water heating, kWh/month
250.2396 221.5192 235.6468 207.5275 199.5505 177.9891 174.8154 183.2661 186.7593 209.7496 222.5179 247.5472 (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 21.0941 19.0527 21.0941 20.4136 21.0941 20.4136 21.0941 21.0941 20.4136 21.0941 20.4136 21.0941 (231)
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 (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 1463.1925 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.5000
Water heating fuel used 2517.1282 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)
mechanical ventilation fans (SFP = 0.9920) 162.3658 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 248.3658 (231)
Electricity for lighting (calculated in Appendix L) 136.3368 (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 4365.0232 (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	1463.1925	0.2100	307.2704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2517.1282	0.2100	528.5969	(264)
Space and water heating			835.8673	(265)
Pumps, fans and electric keep-hot	248.3658	0.1387	34.4514	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			889.9963	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.1200	(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	1463.1925	1.1300	1653.4075	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2517.1282	1.1300	2844.3548	(278)
Space and water heating			4497.7624	(279)
Pumps, fans and electric keep-hot	248.3658	1.5128	375.7278	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			5082.6080	(286)
Dwelling Primary energy Rate (DPER)			97.7400	(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	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:													
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	50.9589	46.0274	50.9589	49.1898	49.0421	45.6005	46.3817	47.8227	47.7508	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	223.9644	198.2597	210.9038	185.7371	178.5977	159.3002	156.4598	164.0232	167.1496	187.7259	199.1535	221.5547	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
										Total per year (kWh/year) = Sum(64)m =		2025.3825	(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													
	70.2641	62.1241	65.9214	57.6994	55.3378	49.2053	48.1964	50.5923	51.6378	58.2148	62.1500	69.4628	(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)													
	94.4410	92.4465	88.6041	80.1381	74.3787	68.3407	64.7801	68.0005	71.7191	78.2456	86.3195	93.3640	(72)
Total internal gains													
	376.1109	383.9490	367.8698	353.4854	334.4478	317.9096	305.0567	306.6953	316.9668	332.4117	353.7638	368.3085	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	441.0844	503.4308	554.7451	624.2467	673.5155	670.2692	638.2170	586.4891	532.5122	470.7725	433.1911	422.8744	(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	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													
	0.9348	0.9117	0.8757	0.8026	0.6946	0.5571	0.4385	0.4839	0.6710	0.8368	0.9118	0.9402	(86)
MIT	18.0466	18.3837	18.9146	19.6329	20.2577	20.6906	20.8729	20.8363	20.4942	19.6934	18.7597	17.9880	(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													
	0.9250	0.8986	0.8567	0.7713	0.6440	0.4793	0.3344	0.3787	0.5995	0.8039	0.8965	0.9312	(89)
MIT 2	16.3770	16.7996	17.4628	18.3456	19.0790	19.5515	19.7176	19.6937	19.3654	18.4428	17.2855	16.3072	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	17.4131	17.7826	18.3637	19.1445	19.8105	20.2584	20.4345	20.4028	20.0659	19.2189	18.2004	17.3503	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4131	17.7826	18.3637	19.1445	19.8105	20.2584	20.4345	20.4028	20.0659	19.2189	18.2004	17.3503	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9000	0.8715	0.8300	0.7527	0.6456	0.5113	0.3921	0.4346	0.6177	0.7859	0.8710	0.9070	(94)
Useful gains	396.9552	438.7379	460.4185	469.8803	434.8010	342.6881	250.2314	254.8783	328.9496	369.9914	377.3095	383.5464	(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													
	956.4892	937.9552	862.2157	738.2291	583.5160	404.0676	273.8243	285.4420	427.2587	620.0933	801.2148	952.3758	(97)
Space heating kWh													
	416.2933	335.4741	298.9371	193.2112	110.6439	0.0000	0.0000	0.0000	0.0000	186.0758	305.2118	423.2091	(98a)
Space heating requirement - total per year (kWh/year)												2269.0563	
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													
	416.2933	335.4741	298.9371	193.2112	110.6439	0.0000	0.0000	0.0000	0.0000	186.0758	305.2118	423.2091	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2269.0563	
Space heating per m2											(98c) / (4) =	43.6357	(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 %)												92.4000	(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													
	416.2933	335.4741	298.9371	193.2112	110.6439	0.0000	0.0000	0.0000	0.0000	186.0758	305.2118	423.2091	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	450.5339	363.0672	323.5250	209.1030	119.7445	0.0000	0.0000	0.0000	0.0000	201.3808	330.3158	458.0185	(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													
	199.4856	176.6104	188.2340	166.9656	161.1033	144.3301	142.4277	149.1015	151.6609	169.4665	178.4678	197.5292	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.9190	85.7333	85.3674	84.6951	83.5925	80.3000	80.3000	80.3000	80.3000	84.5823	85.5205	85.9701	(217)
Fuel for water heating, kWh/month													
	232.1786	205.9997	220.4986	197.1372	192.7246	179.7386	177.3695	185.6805	188.8679	200.3570	208.6843	229.7650	(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	2455.6887 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	2419.0015 (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	4575.7791 (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	2455.6887	0.2100	515.6946	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2419.0015	0.2100	507.9903	(264)
Space and water heating			1023.6849	(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			987.5137	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.9900	(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	2455.6887	1.1300	2774.9282	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2419.0015	1.1300	2733.4717	(278)
Space and water heating			5508.3999	(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			5293.8088	(286)
Target Primary Energy Rate (TPER)			101.8000	(287)

Full SAP Calculation Printout

Property Reference	Flat 201 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 201 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	86 B	DER	10.72	TER	12.13
Environmental	91 B	% DER < TER			11.62
CO_2 Emissions (t/year)	0.84	DFEE	29.24	TFEE	31.69
Compliance Check	See BREL	% DFEE < TFEE			7.75
% DPER < TPER	3.19	DPER	62.38	TPER	64.44

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) =	227.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.4000	(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		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)

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)			93.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.1206		(33)
Party Wall 1			13.6700	0.0000	0.0000	20.0000	273.4000 (32)
Party Floor 1			88.0000			40.0000	3520.0000 (32d)
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) = 8409.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 95.5588 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	72.3000	0.0700	5.0610
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9800	0.4430	2.6491
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)	10.6000	0.0000	0.0000
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) 10.7365 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.8572 (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	56.0684	55.8507	55.6329	54.5442	54.3265	53.2377	53.2377	53.0200	53.6732	54.3265	54.7620	55.1975	(39)
Average = Sum(39)m / 12 =												54.4898	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6371	0.6347	0.6322	0.6198	0.6173	0.6050	0.6050	0.6025	0.6099	0.6173	0.6223	0.6272	(40)
HLP (average)												0.6192	
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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(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	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(64)
									Total per year (kWh/year) = Sum(64)m =			2711.0357	(64)
12Total per year (kWh/year)												2711	(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	85.5494	75.5736	80.0520	69.7943	67.2627	60.1787	59.0658	61.6427	62.5779	70.2984	75.3885	84.5353	(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	(69)
Pumps, fans	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	(71)
Water heating gains (Table 5)												
	114.9857	112.4608	107.5968	96.9365	90.4068	83.5816	79.3896	82.8531	86.9138	94.4871	104.7062	113.6227 (72)
Total internal gains												
	535.4430	548.2331	524.3420	504.5849	477.5118	456.1476	437.5664	438.5878	452.8076	472.4777	503.2403	523.6957 (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	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	611.2705	687.0338	739.8567	814.5301	863.8442	856.9150	816.7792	758.1781	700.6083	632.7849	595.8194	587.4525 (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	41.6612	41.8237	41.9874	42.8254	42.9971	43.8764	43.8764	44.0566	43.5204	42.9971	42.6552	42.3186	
alpha	3.7774	3.7882	3.7992	3.8550	3.8665	3.9251	3.9251	3.9371	3.9014	3.8665	3.8437	3.8212	
util living area													
	0.9203	0.8825	0.8244	0.7035	0.5519	0.3911	0.2853	0.3192	0.5069	0.7473	0.8780	0.9280	(86)
MIT	19.9112	20.1459	20.4257	20.7448	20.9164	20.9836	20.9963	20.9944	20.9552	20.7293	20.3021	19.8820	(87)
Th 2	20.3967	20.3989	20.4011	20.4122	20.4144	20.4255	20.4255	20.4278	20.4211	20.4144	20.4100	20.4055	(88)
util rest of house													
	0.9123	0.8715	0.8088	0.6806	0.5225	0.3576	0.2485	0.2803	0.4691	0.7216	0.8650	0.9207	(89)
MIT 2	19.1078	19.4005	19.7457	20.1352	20.3311	20.4115	20.4230	20.4238	20.3808	20.1258	19.6069	19.0781	(90)
Living area fraction										fLA = Living area / (4) =		0.5440	(91)
MIT	19.5448	19.8060	20.1156	20.4668	20.6495	20.7227	20.7349	20.7342	20.6933	20.4541	19.9851	19.5154	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3948	19.6560	19.9656	20.3168	20.4995	20.5727	20.5849	20.5842	20.5433	20.3041	19.8351	19.3654	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8970	0.8564	0.7965	0.6767	0.5268	0.3663	0.2588	0.2910	0.4772	0.7165	0.8509	0.9059	(94)
Useful gains	548.2945	588.3876	589.3202	551.2213	455.0864	313.8593	211.3550	220.5983	334.3244	453.4200	506.9959	532.1559	(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													
	846.3440	824.1322	749.1327	622.7204	478.0450	317.9742	212.1467	221.8440	345.8328	527.1901	697.3989	837.0935	(97)
Space heating kWh													
	221.7488	158.4204	118.9005	51.4794	17.0812	0.0000	0.0000	0.0000	0.0000	54.8850	137.0902	226.8735	(98a)
Space heating requirement - total per year (kWh/year)												986.4790	
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													
	221.7488	158.4204	118.9005	51.4794	17.0812	0.0000	0.0000	0.0000	0.0000	54.8850	137.0902	226.8735	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												986.4790	
Space heating per m2											(98c) / (4) =	11.2100	(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 %)	89.5000 (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													
	221.7488	158.4204	118.9005	51.4794	17.0812	0.0000	0.0000	0.0000	0.0000	54.8850	137.0902	226.8735	(98)
Space heating efficiency (main heating system 1)													
	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)													
	247.7641	177.0060	132.8497	57.5189	19.0851	0.0000	0.0000	0.0000	0.0000	61.3240	153.1734	253.4900	(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
269.9353 238.7094 253.4020 222.1437 214.9377 193.2248 190.2855 198.0355 200.4404 224.0677 238.9684 266.8855 (64)
Efficiency of water heater 89.5000 (216)
(217)m 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 89.5000 (217)
Fuel for water heating, kWh/month
301.6037 266.7145 283.1307 248.2053 240.1538 215.8936 212.6095 221.2687 223.9557 250.3549 267.0038 298.1961 (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 30.6410 27.6757 30.6410 29.6526 30.6410 29.6526 30.6410 30.6410 29.6526 30.6410 29.6526 30.6410 (231)
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 (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 1102.2112 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 89.5000
Water heating fuel used 3029.0902 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)
mechanical ventilation fans (SFP = 0.9920) 274.7729 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 360.7729 (231)
Electricity for lighting (calculated in Appendix L) 179.6829 (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 4671.7571 (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	1102.2112	0.2100	231.4643	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3029.0902	0.2100	636.1089	(264)
Space and water heating			867.5733	(265)
Pumps, fans and electric keep-hot	360.7729	0.1387	50.0436	(267)
Energy for lighting	179.6829	0.1443	25.9338	(268)
Total CO2, kg/year			943.5507	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.7200	(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	1102.2112	1.1300	1245.4986	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3029.0902	1.1300	3422.8719	(278)
Space and water heating			4668.3705	(279)
Pumps, fans and electric keep-hot	360.7729	1.5128	545.7772	(281)
Energy for lighting	179.6829	1.5338	275.6036	(282)
Total Primary energy kWh/year			5489.7514	(286)
Dwelling Primary energy Rate (DPER)			62.3800	(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	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)
External Wall 1	93.2700	18.7500	74.5200	0.1800	13.4136			(29a)
Total net area of external elements Aum(A, m2)			93.2700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.6089			(33)
Party Wall 1			13.6700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 105.5588 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	72.3000	0.0700	5.0610
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9800	0.0200	0.1196
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)	10.6000	0.0000	0.0000
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)		8.2070	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	42.8159	(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	85.6188	85.4114	85.2081	84.2532	84.0745	83.2429	83.2429	83.0888	83.5632	84.0745	84.4360	84.8138	(39)
Average = Sum(39)m / 12 =												84.2523	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9729	0.9706	0.9683	0.9574	0.9554	0.9459	0.9459	0.9442	0.9496	0.9554	0.9595	0.9638	(40)
HLP (average)												0.9574	
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:													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	269.9353	238.7094	253.4020	222.1437	214.9377	193.2248	190.2855	198.0355	200.4404	224.0677	238.9684	266.8855	(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													
	238.9543	211.3096	224.7104	198.3860	192.7963	174.2782	172.5262	179.1502	180.8376	200.9581	212.7881	236.4782	(64)
										Total per year (kWh/year) = Sum(64)m =		2423.1732	(64)
12Total per year (kWh/year)												2423	(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													
	85.5494	75.5736	80.0520	69.7943	67.2627	60.1787	59.0658	61.6427	62.5779	70.2984	75.3885	84.5353	(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	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	0.0000	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)													
	114.9857	112.4608	107.5968	96.9365	90.4068	83.5816	79.3896	82.8531	86.9138	94.4871	104.7062	113.6227	(72)
Total internal gains													
	535.4430	548.2331	524.3420	504.5849	477.5118	456.1476	437.5664	438.5878	452.8076	472.4777	503.2403	523.6957	(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	0.6300	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	637.0841	734.2852	813.2234	920.0433	995.3616	993.3464	945.8728	866.9749	784.9660	687.3576	627.3357	609.1569	(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	30.1374	30.2105	30.2826	30.6258	30.6909	30.9976	30.9976	31.0550	30.8787	30.6909	30.5595	30.4234	

alpha	3.0092	3.0140	3.0188	3.0417	3.0461	3.0665	3.0665	3.0703	3.0586	3.0461	3.0373	3.0282	
util living area													
	0.9493	0.9235	0.8812	0.7897	0.6560	0.4963	0.3740	0.4202	0.6283	0.8349	0.9245	0.9549	(86)
MIT	19.0333	19.3371	19.7609	20.2980	20.6907	20.9044	20.9699	20.9568	20.7995	20.2791	19.5780	18.9833	(87)
Th 2	20.1059	20.1079	20.1099	20.1190	20.1207	20.1286	20.1286	20.1301	20.1256	20.1207	20.1172	20.1136	(88)
util rest of house													
	0.9424	0.9133	0.8653	0.7626	0.6140	0.4387	0.3046	0.3476	0.5706	0.8069	0.9128	0.9486	(89)
MIT 2	17.8028	18.1844	18.7127	19.3698	19.8227	20.0532	20.1111	20.1035	19.9541	19.3640	18.4989	17.7449	(90)
Living area fraction										fLA = Living area / (4) =		0.5440	(91)
MIT	18.4722	18.8114	19.2829	19.8747	20.2949	20.5163	20.5783	20.5677	20.4139	19.8618	19.0859	18.4186	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4722	18.8114	19.2829	19.8747	20.2949	20.5163	20.5783	20.5677	20.4139	19.8618	19.0859	18.4186	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9261	0.8953	0.8482	0.7545	0.6227	0.4649	0.3409	0.3847	0.5905	0.7976	0.8960	0.9332	(94)
Useful gains	589.9884	657.3878	689.7900	694.1346	619.8226	461.8369	322.4284	333.5621	463.5113	548.2605	562.0774	568.4446	(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													
	1213.4031	1188.1941	1089.2081	924.6541	722.6108	492.4862	331.1648	346.2902	527.6134	778.6816	1012.0430	1205.9315	(97)
Space heating kWh													
	463.8206	356.7019	297.1670	165.9740	76.4744	0.0000	0.0000	0.0000	0.0000	171.4333	323.9752	474.2902	(98a)
Space heating requirement - total per year (kWh/year)												2329.8367	
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													
	463.8206	356.7019	297.1670	165.9740	76.4744	0.0000	0.0000	0.0000	0.0000	171.4333	323.9752	474.2902	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2329.8367	
Space heating per m2											(98c) / (4) =	26.4754	(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 %)												92.4000	(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													
	463.8206	356.7019	297.1670	165.9740	76.4744	0.0000	0.0000	0.0000	0.0000	171.4333	323.9752	474.2902	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	501.9703	386.0410	321.6094	179.6256	82.7645	0.0000	0.0000	0.0000	0.0000	185.5339	350.6225	513.3011	(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													
	238.9543	211.3096	224.7104	198.3860	192.7963	174.2782	172.5262	179.1502	180.8376	200.9581	212.7881	236.4782	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.7764	85.4937	84.9811	84.0016	82.5685	80.3000	80.3000	80.3000	80.3000	84.0428	85.2793	85.8413	(217)
Fuel for water heating, kWh/month													
	278.5780	247.1638	264.4239	236.1692	233.4986	217.0339	214.8521	223.1011	225.2024	239.1141	249.5190	275.4831	(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												2521.4683	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2904.1394	(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	4843.1593 (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	2521.4683	0.2100	529.5083	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.1394	0.2100	609.8693	(264)
Space and water heating			1139.3776	(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			1067.5051	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1300	(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	2521.4683	1.1300	2849.2592	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.1394	1.1300	3281.6775	(278)
Space and water heating			6130.9367	(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			5670.3999	(286)
Target Primary Energy Rate (TPER)			64.4400	(287)

Full SAP Calculation Printout

Property Reference	Flat 201 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 201 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	84 B	DER	13.75	TER	14.13
Environmental	90 B	% DER < TER			2.69
CO_2 Emissions (t/year)	0.76	DFEE	33.41	TFEE	32.59
Compliance Check	See BREL	% DFEE < TFEE			-2.50
% DPER < TPER	-4.44	DPER	78.83	TPER	75.48

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 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 2.5200	(2b) =	153.7200	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		153.7200	(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)

External Wall 1	80.2100	23.4300	56.7800	0.1500	8.5170	14.0000	794.9200 (29a)
Total net area of external elements Aum(A, m2)			80.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.7302		(33)
Party Wall 1			8.9700	0.0000	0.0000	20.0000	179.4000 (32)
Party Floor 1			61.0000			40.0000	2440.0000 (32d)
Party Ceiling 1			61.0000			30.0000	1830.0000 (32b)
Internal Wall 1			84.5700			9.0000	761.1300 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 6005.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.4500 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	12.6000	0.0900	1.1340
E17 Corner (inverted – internal area greater than external area)	5.0400	-0.0900	-0.4536
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)	63.6600	0.0700	4.4562
E18 Party wall between dwellings	2.5200	0.0600	0.1512
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)	7.1200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.8421 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 40.5723 (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	11.4248	11.2774	11.1300	10.3928	10.2454	9.5083	9.5083	9.3608	9.8031	10.2454	10.5402	10.8351	(38)
Heat transfer coeff	51.9971	51.8497	51.7023	50.9651	50.8177	50.0806	50.0806	49.9331	50.3754	50.8177	51.1126	51.4074	(39)
Average = Sum(39)m / 12 =												50.9283	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8524	0.8500	0.8476	0.8355	0.8331	0.8210	0.8210	0.8186	0.8258	0.8331	0.8379	0.8427	(40)
HLP (average)												0.8349	
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:
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 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

243.1137	215.0818	228.5579	200.9420	194.8158	175.5642	173.2098	180.0254	181.9471	202.8802	215.7439	240.4432	(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												
243.1137	215.0818	228.5579	200.9420	194.8158	175.5642	173.2098	180.0254	181.9471	202.8802	215.7439	240.4432	(64)
								Total per year (kWh/year) = Sum(64)m =			2452.3250	(64)
12Total per year (kWh/year)											2452	(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													
76.6312	67.7174	71.7914	62.7447	60.5721	54.3066	53.3881	55.6543	56.4289	63.2536	67.6663	75.7433	(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													