	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	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)												
	-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	32.0822	32.1734	32.2651	32.7318	32.8268	33.3099	33.3099	33.4083	33.1150	32.8268	32.6374	32.4502	
alpha	3.1388	3.1449	3.1510	3.1821	3.1885	3.2207	3.2207	3.2272	3.2077	3.1885	3.1758	3.1633	
util living area	0.8914	0.8312	0.7514	0.6243	0.4838	0.3462	0.2521	0.2810	0.4437	0.6783	0.8382	0.9036	(86)
MIT	19.6223	19.9762	20.3398	20.6930	20.8876	20.9717	20.9924	20.9891	20.9364	20.6645	20.1098	19.5587	(87)
Th 2	20.2081	20.2102	20.2123	20.2227	20.2248	20.2352	20.2352	20.2373	20.2310	20.2248	20.2206	20.2164	(88)
util rest of house	0.8798	0.8151	0.7296	0.5955	0.4491	0.3069	0.2091	0.2356	0.3995	0.6452	0.8199	0.8931	(89)
MIT 2	18.6077	19.0416	19.4813	19.9014	20.1179	20.2127	20.2305	20.2303	20.1774	19.8815	19.2216	18.5352	(90)
Living area fraction									fLA = Living area / (4) =			0.3654	(91)
MIT	18.9784	19.3831	19.7950	20.1907	20.3992	20.4900	20.5089	20.5076	20.4547	20.1676	19.5462	18.9092	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8284	19.2331	19.6450	20.0407	20.2492	20.3400	20.3589	20.3576	20.3047	20.0176	19.3962	18.7592	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8558	0.7926	0.7125	0.5885	0.4502	0.3124	0.2161	0.2428	0.4038	0.6358	0.7979	0.8696	(94)
Useful gains	482.4865	537.0157	544.9754	505.0134	412.2889	282.5374	187.1673	196.0211	301.1087	412.5249	452.6499	464.2622	(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	755.4372	743.1660	679.6266	567.7865	434.4496	287.4649	188.2486	197.6153	312.5667	478.5798	628.4889	748.4509	(97)
Space heating kWh	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(98a)
Space heating requirement - total per year (kWh/year)												890.6582	
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	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												890.6582	
Space heating per m2										(98c) / (4) =		14.6010	(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	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(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)	226.8998	154.7855	111.9335	50.4990	18.4218	0.0000	0.0000	0.0000	0.0000	54.9105	141.4570	236.2417	(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	21.1295	19.0847	21.1295	20.4479	21.1295	20.4479	21.1295	21.1295	20.4479	21.1295	20.4479	21.1295 (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	995.1489 (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)	162.7833 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	248.7833 (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	4121.7869 (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	995.1489	0.2100	208.9813	(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			784.3871	(265)
Pumps, fans and electric keep-hot	248.7833	0.1387	34.5093	(267)
Energy for lighting	137.8268	0.1443	19.8927	(268)
Total CO2, kg/year			838.7891	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.7500	(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	995.1489	1.1300	1124.5182	(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			4220.7498	(279)
Pumps, fans and electric keep-hot	248.7833	1.5128	376.3594	(281)
Energy for lighting	137.8268	1.5338	211.4034	(282)
Total Primary energy kWh/year			4808.5126	(286)
Dwelling Primary energy Rate (DPER)			78.8300	(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	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)

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) =	0.1301 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3801 (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) =	0.2946 (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	0.3756	0.3682	0.3609	0.3240	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3461	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(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)
External Wall 1	80.2100	15.2500	64.9600	0.1800	11.6928			(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) =		28.8646			(33)
Party Wall 1			8.9700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 108.4500 (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	0.0200	0.1348
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)		7.9911 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.8557 (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	28.9419	28.8029	28.6667	28.0271	27.9074	27.3502	27.3502	27.2471	27.5648	27.9074	28.1495	28.4026	(38)
Heat transfer coeff	65.7975	65.6586	65.5224	64.8827	64.7630	64.2059	64.2059	64.1027	64.4205	64.7630	65.0052	65.2583	(39)
Average = Sum(39)m / 12 =												64.8821	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0786	1.0764	1.0741	1.0637	1.0617	1.0526	1.0526	1.0509	1.0561	1.0617	1.0657	1.0698	(40)
HLP (average)												1.0636	

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

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (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)

---

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)

---

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)

---

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	27.9285	27.9876	28.0458	28.3223	28.3746	28.6208	28.6208	28.6669	28.5255	28.3746	28.2689	28.1593	
alpha	2.8619	2.8658	2.8697	2.8882	2.8916	2.9081	2.9081	2.9111	2.9017	2.8916	2.8846	2.8773	
util living area													
	0.9295	0.8928	0.8409	0.7463	0.6192	0.4701	0.3518	0.3877	0.5737	0.7843	0.8960	0.9373	(86)
MIT	19.0481	19.3975	19.8283	20.3297	20.6942	20.9004	20.9681	20.9571	20.8170	20.3350	19.6158	18.9835	(87)
Th 2	20.0183	20.0202	20.0220	20.0306	20.0322	20.0398	20.0398	20.0412	20.0369	20.0322	20.0290	20.0256	(88)
util rest of house													
	0.9198	0.8788	0.8203	0.7147	0.5736	0.4093	0.2795	0.3130	0.5120	0.7497	0.8800	0.9285	(89)
MIT 2	17.7617	18.1959	18.7263	19.3315	19.7457	19.9643	20.0224	20.0164	19.8873	19.3550	18.4818	17.6858	(90)
Living area fraction										fLA = Living area / (4) =		0.3654	(91)
MIT	18.2318	18.6350	19.1290	19.6962	20.0923	20.3064	20.3679	20.3601	20.2270	19.7131	18.8962	18.1600	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2318	18.6350	19.1290	19.6962	20.0923	20.3064	20.3679	20.3601	20.2270	19.7131	18.8962	18.1600	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8971	0.8548	0.7987	0.7028	0.5766	0.4266	0.3047	0.3384	0.5248	0.7369	0.8572	0.9068	(94)
Useful gains	482.2636	541.5145	561.3401	546.5421	473.9140	345.4482	236.2366	245.9994	355.6183	442.1285	459.7574	463.6409	(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													
	916.6769	901.8178	827.4816	700.4885	543.5087	366.3830	241.9232	253.8538	394.7074	590.1926	766.8124	911.0059	(97)
Space heating kWh													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(98a)
Space heating requirement - total per year (kWh/year)												1590.0352	
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													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1590.0352	
Space heating per m2											(98c) / (4) =	26.0662	(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													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(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)													
	349.7873	262.0388	214.2957	119.9582	56.0373	0.0000	0.0000	0.0000	0.0000	119.2204	239.2636	360.2160	(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	85.2859	84.9329	84.3660	83.4103	82.1371	80.3000	80.3000	80.3000	80.3000	83.3710	84.7181	85.3682	(217)
Fuel for water heating, kWh/month													
	248.1244	220.4967	236.4033	211.8545	209.6141	194.4045	191.8535	199.8860	201.3836	214.8763	223.1106	245.4063	(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	-13.5810	-20.4023	-31.2295	-37.4723	-42.5137	-40.4688	-39.9849	-36.6967	-31.2778	-24.3483	-15.3725	-11.6004	(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	-4.2822	-9.2564	-18.8685	-29.0425	-39.0963	-39.5307	-39.0576	-32.7430	-23.5805	-13.4555	-5.7866	-3.3675	(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												1720.8174	(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	2597.4138 (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	-603.0156 (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	3949.7441 (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	1720.8174	0.2100	361.3716	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2597.4138	0.2100	545.4569	(264)
Space and water heating			906.8285	(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	-344.9483	0.1333	-45.9705	
PV Unit electricity exported	-258.0673	0.1252	-32.3076	
Total			-78.2782	(269)
Total CO2, kg/year			861.9169	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.1300	(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	1720.8174	1.1300	1944.5236	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2597.4138	1.1300	2935.0776	(278)
Space and water heating			4879.6012	(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	-344.9483	1.4925	-514.8215	
PV Unit electricity exported	-258.0673	0.4595	-118.5826	
Total			-633.4041	(283)
Total Primary energy kWh/year			4604.1159	(286)
Target Primary Energy Rate (TPER)			75.4800	(287)

Full SAP Calculation Printout

Property Reference	Flat 202 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 202 VL - Be Lean	Prop Type Ref	Flat 203 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	84 B	DER	14.01	TER	15.27
Environmental	90 B	% DER < TER			8.25
CO_2 Emissions (t/year)	0.66	DFEE	31.35	TFEE	32.01
Compliance Check	See BREL	% DFEE < TFEE			2.06
% DPER < TPER	1.36	DPER	81.04	TPER	82.15

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.1500 (18)
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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)

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)			46.8500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.4028		(33)
Party Wall 1			31.7900	0.0000	0.0000	20.0000	635.8000 (32)
Party Floor 1			51.6300			40.0000	2065.2000 (32d)
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) = 5131.6400 (34)
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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
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)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4628 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.8656 (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	35.7657	35.6380	35.5102	34.8715	34.7437	34.1049	34.1049	33.9772	34.3604	34.7437	34.9992	35.2547	(39)
Average = Sum(39)m / 12 =												34.8395	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6927	0.6903	0.6878	0.6754	0.6729	0.6606	0.6606	0.6581	0.6655	0.6729	0.6779	0.6828	(40)
HLP (average)												0.6748	
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	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)

---

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	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)												
	-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)

---

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)

---

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	39.8554	39.9982	40.1421	40.8774	41.0277	41.7962	41.7962	41.9533	41.4854	41.0277	40.7282	40.4330	
alpha	3.6570	3.6665	3.6761	3.7252	3.7352	3.7864	3.7864	3.7969	3.7657	3.7352	3.7152	3.6955	
util living area													
	0.9052	0.8686	0.8044	0.6682	0.5062	0.3528	0.2581	0.2958	0.4868	0.7306	0.8615	0.9128 (86)	
MIT	19.9264	20.1425	20.4335	20.7637	20.9288	20.9863	20.9968	20.9947	20.9551	20.7254	20.3058	19.8999 (87)	
Th 2	20.3473	20.3494	20.3516	20.3626	20.3648	20.3758	20.3758	20.3780	20.3714	20.3648	20.3604	20.3560 (88)	
util rest of house													
	0.8956	0.8561	0.7868	0.6433	0.4758	0.3196	0.2219	0.2566	0.4470	0.7027	0.8465	0.9039 (89)	
MIT 2	19.0871	19.3552	19.7120	20.1102	20.2954	20.3645	20.3737	20.3744	20.3320	20.0762	19.5699	19.0609 (90)	
Living area fraction										fLA = Living area / (4) =		0.6328 (91)	
MIT	19.6181	19.8534	20.1686	20.5237	20.6962	20.7579	20.7680	20.7669	20.7263	20.4870	20.0356	19.5918 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.4681	19.7034	20.0186	20.3737	20.5462	20.6079	20.6180	20.6169	20.5763	20.3370	19.8856	19.4418 (93)	

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8808	0.8424	0.7772	0.6437	0.4846	0.3320	0.2360	0.2717	0.4602	0.7014	0.8343	0.8894 (94)	
Useful gains	359.5667	380.1810	381.6035	358.5317	295.0161	202.7075	136.5856	142.5228	215.1966	291.4173	329.3645	350.6024 (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													
	542.4997	527.5623	480.0476	400.1053	307.3507	204.8999	137.0331	143.2788	222.5269	338.3000	447.4845	537.3442 (97)	
Space heating kWh													
	136.1022	99.0402	73.2424	29.9330	9.1769	0.0000	0.0000	0.0000	0.0000	34.8807	85.0464	138.9359 (98a)	
Space heating requirement - total per year (kWh/year)												606.3578	
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													
	136.1022	99.0402	73.2424	29.9330	9.1769	0.0000	0.0000	0.0000	0.0000	34.8807	85.0464	138.9359 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												606.3578	
Space heating per m2											(98c) / (4) =	11.7443 (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													
	136.1022	99.0402	73.2424	29.9330	9.1769	0.0000	0.0000	0.0000	0.0000	34.8807	85.0464	138.9359	(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)													
	152.0695	110.6595	81.8351	33.4446	10.2536	0.0000	0.0000	0.0000	0.0000	38.9729	95.0239	155.2356	(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 1 677.4947 (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 3570.2196 (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	677.4947	0.2100	142.2739	(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			669.3034	(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			723.2019	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.0100	(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	677.4947	1.1300	765.5690	(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			3601.4898	(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			4183.8411	(286)
Dwelling Primary energy Rate (DPER)			81.0400	(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)
External Wall 1	46.8500	12.9200	33.9300	0.1800	6.1074			(29a)
Total net area of external elements Aum(A, m2)			46.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.6272			(33)
Party Wall 1			31.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.3926 (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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
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)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.8444 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	25.4716 (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	50.8865	50.7531	50.6223	50.0080	49.8931	49.3581	49.3581	49.2590	49.5642	49.8931	50.1256	50.3687	(39)
Average = Sum(39)m / 12 =												50.0075	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9856	0.9830	0.9805	0.9686	0.9664	0.9560	0.9560	0.9541	0.9600	0.9664	0.9709	0.9756	(40)
HLP (average)												0.9686	
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	86.9077	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	76.5233	84.7223	76.5233	79.0741	76.5233	79.0741	76.5233	76.5233	79.0741	76.5233	79.0741	76.5233	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)													
	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)
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)

---
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	30.8308	30.9118	30.9917	31.3724	31.4447	31.7855	31.7855	31.8495	31.6534	31.4447	31.2988	31.1478
alpha	3.0554	3.0608	3.0661	3.0915	3.0963	3.1190	3.1190	3.1233	3.1102	3.0963	3.0866	3.0765
util living area												

	0.9403	0.9168	0.8729	0.7709	0.6240	0.4616	0.3464	0.3964	0.6128	0.8251	0.9144	0.9456 (86)
MIT	19.1739	19.4342	19.8411	20.3743	20.7443	20.9266	20.9775	20.9657	20.8222	20.3321	19.6849	19.1352 (87)
Th 2	20.0954	20.0975	20.0996	20.1096	20.1115	20.1202	20.1202	20.1218	20.1168	20.1115	20.1077	20.1037 (88)
util rest of house												
	0.9321	0.9057	0.8559	0.7421	0.5810	0.4056	0.2805	0.3261	0.5543	0.7955	0.9011	0.9381 (89)
MIT 2	17.9684	18.2948	18.8004	19.4485	19.8692	20.0636	20.1075	20.1013	19.9672	19.4164	18.6210	17.9254 (90)
Living area fraction										fLA = Living area / (4) =		0.6328 (91)
MIT	18.7312	19.0158	19.4589	20.0343	20.4230	20.6097	20.6580	20.6483	20.5083	19.9958	19.2942	18.6909 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7312	19.0158	19.4589	20.0343	20.4230	20.6097	20.6580	20.6483	20.5083	19.9958	19.2942	18.6909 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9168	0.8898	0.8421	0.7395	0.5966	0.4372	0.3212	0.3688	0.5811	0.7913	0.8867	0.9233	(94)
Useful gains	377.9852	408.7951	425.6896	429.4317	382.1779	281.7880	196.0897	202.8048	282.0239	336.5901	354.5482	367.0623	(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													
	734.3537	716.4206	656.0099	556.8035	435.2160	296.6249	200.2933	209.2662	317.6201	468.7863	611.2411	729.8891	(97)
Space heating kWh													
	265.1381	206.7243	171.3583	91.7077	39.4603	0.0000	0.0000	0.0000	0.0000	98.3540	184.8189	269.9431	(98a)
Space heating requirement - total per year (kWh/year)												1327.5048	
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													
	265.1381	206.7243	171.3583	91.7077	39.4603	0.0000	0.0000	0.0000	0.0000	98.3540	184.8189	269.9431	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1327.5048	
Space heating per m2											(98c) / (4) =	25.7119	(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													
	265.1381	206.7243	171.3583	91.7077	39.4603	0.0000	0.0000	0.0000	0.0000	98.3540	184.8189	269.9431	(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		(210)
Space heating fuel (main heating system)													
	286.9460	223.7276	185.4527	99.2507	42.7060	0.0000	0.0000	0.0000	0.0000	106.4437	200.0205	292.1462	(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	84.9973	84.7252	84.1860	83.1584	81.8624	80.3000	80.3000	80.3000	80.3000	83.2625	84.4618	85.0565	(217)
Fuel for water heating, kWh/month													
	234.0989	207.9239	223.0355	200.0937	196.1248	179.1241	176.7630	185.0456	188.2220	203.0462	210.7771	231.6437	(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												1436.6935	(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												2435.8986	(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	3661.5908 (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	1436.6935	0.2100	301.7056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2435.8986	0.2100	511.5387	(264)
Space and water heating			813.2443	(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			788.4387	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.2700	(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	1436.6935	1.1300	1623.4637	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2435.8986	1.1300	2752.5654	(278)
Space and water heating			4376.0290	(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			4241.4779	(286)
Target Primary Energy Rate (TPER)			82.1500	(287)

Full SAP Calculation Printout

Property Reference	Flat 202 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 202 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	84 B	DER	14.37	TER	14.85
Environmental	90 B	% DER < TER			3.23
CO_2 Emissions (t/year)	0.68	DFEE	31.94	TFEE	31.43
Compliance Check	See BREL	% DFEE < TFEE			-1.62
% DPER < TPER	-3.70	DPER	82.45	TPER	79.51

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

---

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)

---

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)			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)

External Wall 1	66.7800	18.5200	48.2600	0.1500	7.2390	14.0000	675.6400 (29a)
Total net area of external elements Aum(A, m2)			66.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.9585		(33)
Party Wall 1			18.4000	0.0000	0.0000	20.0000	368.0000 (32)
Party Floor 1			52.0000			40.0000	2080.0000 (32d)
Party Ceiling 1			52.0000			30.0000	1560.0000 (32b)
Internal Wall 1			45.1100			9.0000	405.9900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5089.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.8775 (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	7.5600	0.0600	0.4536
E16 Corner (normal)	2.5200	0.0900	0.2268
E17 Corner (inverted – internal area greater than external area)	5.0400	-0.0900	-0.4536
E7 Party floor between dwellings (in blocks of flats)	53.0000	0.0700	3.7100
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)	14.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0481 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 33.0066 (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	9.7392	9.6135	9.4878	8.8595	8.7338	8.1054	8.1054	7.9797	8.3567	8.7338	8.9851	9.2365	(38)
Heat transfer coeff	42.7458	42.6201	42.4944	41.8660	41.7404	41.1120	41.1120	40.9863	41.3633	41.7404	41.9917	42.2431	(39)
Average = Sum(39)m / 12 =												41.8346	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8220	0.8196	0.8172	0.8051	0.8027	0.7906	0.7906	0.7882	0.7954	0.8027	0.8075	0.8124	(40)
HLP (average)												0.8045	
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

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)

---
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	(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)												
	-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	33.0743	33.1718	33.2699	33.7693	33.8710	34.3887	34.3887	34.4941	34.1797	33.8710	33.6682	33.4679	
alpha	3.2050	3.2115	3.2180	3.2513	3.2581	3.2926	3.2926	3.2996	3.2786	3.2581	3.2445	3.2312	
util living area													
	0.8681	0.7986	0.7165	0.5969	0.4682	0.3373	0.2440	0.2661	0.4115	0.6341	0.8055	0.8824	(86)
MIT	19.8089	20.1483	20.4609	20.7482	20.9057	20.9764	20.9939	20.9918	20.9532	20.7425	20.2613	19.7458	(87)
Th 2	20.2343	20.2364	20.2385	20.2489	20.2510	20.2615	20.2615	20.2636	20.2573	20.2510	20.2468	20.2426	(88)
util rest of house													
	0.8551	0.7812	0.6942	0.5690	0.4352	0.3002	0.2037	0.2244	0.3709	0.6014	0.7857	0.8705	(89)
MIT 2	18.8556	19.2687	19.6439	19.9858	20.1611	20.2425	20.2577	20.2583	20.2179	19.9892	19.4222	18.7846	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	19.4741	19.8394	20.1740	20.4804	20.6442	20.7187	20.7354	20.7342	20.6950	20.4780	19.9666	19.4082	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3241	19.6894	20.0240	20.3304	20.4942	20.5687	20.5854	20.5842	20.5450	20.3280	19.8166	19.2582	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8376	0.7677	0.6875	0.5721	0.4461	0.3157	0.2215	0.2427	0.3868	0.6049	0.7734	0.8528	(94)
Useful gains	432.7314	477.3982	476.2095	432.1050	349.9539	241.4042	162.9383	170.2511	258.5620	359.8041	403.3063	416.8962	(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													
	642.2176	630.3269	574.6946	478.5469	367.0731	245.3843	163.8462	171.4949	266.5865	406.0499	533.9930	636.1057	(97)
Space heating kWh													
	155.8577	102.7682	73.2729	33.4382	12.7367	0.0000	0.0000	0.0000	0.0000	34.4069	94.0944	163.0918	(98a)
Space heating requirement - total per year (kWh/year)												669.6668	
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													
	155.8577	102.7682	73.2729	33.4382	12.7367	0.0000	0.0000	0.0000	0.0000	34.4069	94.0944	163.0918	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												669.6668	
Space heating per m2											(98c) / (4) =	12.8782	(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													
	155.8577	102.7682	73.2729	33.4382	12.7367	0.0000	0.0000	0.0000	0.0000	34.4069	94.0944	163.0918	(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)													
	174.1427	114.8248	81.8691	37.3611	14.2309	0.0000	0.0000	0.0000	0.0000	38.4435	105.1335	182.2255	(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 19.0897 17.2423 19.0897 18.4739 19.0897 18.4739 19.0897 19.0897 18.4739 19.0897 18.4739 19.0897 (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 1 748.2311 (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) 138.7661 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 224.7661 (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 3673.0834 (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	748.2311	0.2100	157.1285	(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			697.7088	(265)
Pumps, fans and electric keep-hot	224.7661	0.1387	31.1778	(267)
Energy for lighting	125.8946	0.1443	18.1705	(268)
Total CO2, kg/year			747.0571	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.3700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	748.2311	1.1300	845.5011	(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			3754.3377	(279)
Pumps, fans and electric keep-hot	224.7661	1.5128	340.0262	(281)
Energy for lighting	125.8946	1.5338	193.1013	(282)
Total Primary energy kWh/year			4287.4652	(286)
Dwelling Primary energy Rate (DPER)			82.4500	(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	2.5200 (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)

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)
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)

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)
External Wall 1	66.7800	13.0100	53.7700	0.1800	9.6786			(29a)
Total net area of external elements Aum(A, m2)			66.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.2855			(33)
Party Wall 1			18.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.8775 (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	7.5600	0.0600	0.4536
E16 Corner (normal)	2.5200	0.0900	0.2268
E17 Corner (inverted – internal area greater than external area)	5.0400	-0.0900	-0.4536
E7 Party floor between dwellings (in blocks of flats)	53.0000	0.0700	3.7100
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)	14.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.1971	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	30.4826	(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	55.5264	55.3935	55.2633	54.6515	54.5370	54.0041	54.0041	53.9054	54.2094	54.5370	54.7686	55.0107	(39)
Average = Sum(39)m / 12 =												54.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0678	1.0653	1.0628	1.0510	1.0488	1.0385	1.0385	1.0366	1.0425	1.0488	1.0532	1.0579	(40)
HLP (average)												1.0510	
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)

	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													
	77.0499	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	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													
	376.1528	383.9955	367.9118	353.5288	334.4898	317.9530	305.0986	306.7373	317.0101	332.4537	353.8072	368.3504	(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	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)

---
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	28.0629	28.1302	28.1965	28.5121	28.5720	28.8539	28.8539	28.9067	28.7447	28.5720	28.4512	28.3260	
alpha	2.8709	2.8753	2.8798	2.9008	2.9048	2.9236	2.9236	2.9271	2.9163	2.9048	2.8967	2.8884	

util living area													
	0.9139	0.8687	0.8110	0.7161	0.5949	0.4515	0.3349	0.3631	0.5335	0.7450	0.8729	0.9234	(86)
MIT	19.1896	19.5553	19.9632	20.4112	20.7290	20.9122	20.9726	20.9647	20.8515	20.4349	19.7507	19.1223	(87)
Th 2	20.0272	20.0293	20.0314	20.0411	20.0429	20.0513	20.0513	20.0529	20.0481	20.0429	20.0392	20.0354	(88)
util rest of house													
	0.9025	0.8527	0.7884	0.6835	0.5499	0.3928	0.2664	0.2931	0.4740	0.7081	0.8546	0.9131	(89)
MIT 2	17.9428	18.3939	18.8925	19.4307	19.7900	19.9849	20.0364	20.0326	19.9279	19.4736	18.6516	17.8648	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	18.7518	19.1475	19.5872	20.0669	20.3993	20.5866	20.6438	20.6374	20.5272	20.0973	19.3648	18.6808	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7518	19.1475	19.5872	20.0669	20.3993	20.5866	20.6438	20.6374	20.5272	20.0973	19.3648	18.6808	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8846	0.8359	0.7770	0.6844	0.5672	0.4264	0.3096	0.3367	0.5047	0.7104	0.8398	0.8956	(94)
Useful gains	442.2648	497.2546	510.0918	486.6520	416.8424	305.1217	213.1287	221.5717	317.6595	401.7355	421.6498	424.7886	(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													
	802.4563	789.2180	723.2405	610.2854	474.4328	323.2984	218.3839	228.4176	348.4143	517.9565	671.7231	796.5957	(97)
Space heating kWh													
	267.9825	196.1994	158.5826	89.0161	42.8472	0.0000	0.0000	0.0000	0.0000	86.4684	180.0528	276.6245	(98a)
Space heating requirement - total per year (kWh/year)												1297.7736	
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													
	267.9825	196.1994	158.5826	89.0161	42.8472	0.0000	0.0000	0.0000	0.0000	86.4684	180.0528	276.6245	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1297.7736	
Space heating per m2											(98c) / (4) =	24.9572	(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													
	267.9825	196.1994	158.5826	89.0161	42.8472	0.0000	0.0000	0.0000	0.0000	86.4684	180.0528	276.6245	(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)													
	290.0243	212.3370	171.6262	96.3377	46.3715	0.0000	0.0000	0.0000	0.0000	93.5806	194.8623	299.3772	(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	85.0146	84.6074	84.0163	83.0953	81.9658	80.3000	80.3000	80.3000	80.3000	83.0131	84.4004	85.1030	(217)
Fuel for water heating, kWh/month													
	234.6486	208.7410	224.0444	200.9326	196.5494	179.7386	177.3695	185.6805	188.8679	204.1442	211.4537	232.1060	(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												1404.5168	(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												2444.2765	(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	3549.9527 (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	1404.5168	0.2100	294.9485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2444.2765	0.2100	513.2981	(264)
Space and water heating			808.2466	(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			772.0855	(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	1404.5168	1.1300	1587.1040	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2444.2765	1.1300	2762.0325	(278)
Space and water heating			4349.1365	(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			4134.6511	(286)
Target Primary Energy Rate (TPER)			79.5100	(287)

Full SAP Calculation Printout

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

SAP Rating	84 B	DER	13.88	TER	15.09
Environmental	90 B	% DER < TER			8.02
CO_2 Emissions (t/year)	0.65	DFEE	30.64	TFEE	31.23
Compliance Check	See BREL	% DFEE < TFEE			1.91
% DPER < TPER	1.04	DPER	80.36	TPER	81.20

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

---

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	0 * 10	= 0.0000	(7a)
Number of passive vents	0 * 10	= 0.0000	(7b)
Number of flueless gas fires	0 * 40	= 0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5)	= 0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	= 0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	= 0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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)

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)			46.8500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.4028		(33)
Party Wall 1			31.7900	0.0000	0.0000	20.0000	635.8000 (32)
Party Floor 1			51.6300			40.0000	2065.2000 (32d)
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) = 5131.6400 (34)
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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
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)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4628 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.8656 (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	35.7657	35.6380	35.5102	34.8715	34.7437	34.1049	34.1049	33.9772	34.3604	34.7437	34.9992	35.2547	(39)
Average = Sum(39)m / 12 =												34.8395	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6927	0.6903	0.6878	0.6754	0.6729	0.6606	0.6606	0.6581	0.6655	0.6729	0.6779	0.6828	(40)
HLP (average)												0.6748	
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	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)

---

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	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)												
	-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)

---

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)

---

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	39.8554	39.9982	40.1421	40.8774	41.0277	41.7962	41.7962	41.9533	41.4854	41.0277	40.7282	40.4330	
alpha	3.6570	3.6665	3.6761	3.7252	3.7352	3.7864	3.7864	3.7969	3.7657	3.7352	3.7152	3.6955	
util living area													
	0.8986	0.8569	0.7891	0.6541	0.4974	0.3477	0.2537	0.2882	0.4699	0.7113	0.8509	0.9072	(86)
MIT	19.9624	20.1898	20.4727	20.7802	20.9328	20.9869	20.9970	20.9952	20.9601	20.7501	20.3404	19.9325	(87)
Th 2	20.3473	20.3494	20.3516	20.3626	20.3648	20.3758	20.3758	20.3780	20.3714	20.3648	20.3604	20.3560	(88)
util rest of house													
	0.8885	0.8436	0.7709	0.6291	0.4673	0.3149	0.2181	0.2498	0.4310	0.6828	0.8352	0.8978	(89)
MIT 2	19.1314	19.4126	19.7581	20.1284	20.2995	20.3650	20.3738	20.3747	20.3365	20.1034	19.6113	19.1011	(90)
Living area fraction										fLA = Living area / (4) =		0.6328	(91)
MIT	19.6572	19.9044	20.2103	20.5408	20.7002	20.7586	20.7681	20.7673	20.7311	20.5126	20.0727	19.6272	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5072	19.7544	20.0603	20.3908	20.5502	20.6086	20.6181	20.6173	20.5811	20.3626	19.9227	19.4772	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8737	0.8304	0.7622	0.6303	0.4762	0.3272	0.2319	0.2646	0.4441	0.6827	0.8235	0.8833	(94)
Useful gains	366.7401	389.6369	389.4996	361.9292	295.8453	202.8359	136.6178	142.6034	216.1807	296.3657	336.2185	357.0718	(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													
	543.8968	529.3811	481.5279	400.7026	307.4904	204.9213	137.0388	143.2928	222.6935	339.1902	448.7836	538.5921	(97)
Space heating kWh													
	131.8046	93.9081	68.4690	27.9169	8.6640	0.0000	0.0000	0.0000	0.0000	31.8614	81.0469	135.0511	(98a)
Space heating requirement - total per year (kWh/year)												578.7220	
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													
	131.8046	93.9081	68.4690	27.9169	8.6640	0.0000	0.0000	0.0000	0.0000	31.8614	81.0469	135.0511	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												578.7220	
Space heating per m2											(98c) / (4) =	11.2090	(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													
	131.8046	93.9081	68.4690	27.9169	8.6640	0.0000	0.0000	0.0000	0.0000	31.8614	81.0469	135.0511	(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)													
	147.2677	104.9253	76.5017	31.1920	9.6804	0.0000	0.0000	0.0000	0.0000	35.5994	90.5552	150.8951	(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	646.6167 (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	3539.3416 (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	646.6167	0.2100	135.7895	(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			662.8190	(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			716.7175	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.8800	(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	646.6167	1.1300	730.6769	(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			3566.5976	(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			4148.9489	(286)
Dwelling Primary energy Rate (DPER)			80.3600	(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)
External Wall 1	46.8500	12.9200	33.9300	0.1800	6.1074			(29a)
Total net area of external elements Aum(A, m2)			46.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.6272			(33)
Party Wall 1			31.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.3926 (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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
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)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.8444 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	25.4716 (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	50.8865	50.7531	50.6223	50.0080	49.8931	49.3581	49.3581	49.2590	49.5642	49.8931	50.1256	50.3687	(39)
Average = Sum(39)m / 12 =												50.0075	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9856	0.9830	0.9805	0.9686	0.9664	0.9560	0.9560	0.9541	0.9600	0.9664	0.9709	0.9756	(40)
HLP (average)												0.9686	
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 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
374.2383 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	30.8308	30.9118	30.9917	31.3724	31.4447	31.7855	31.7855	31.8495	31.6534	31.4447	31.2988	31.1478
alpha	3.0554	3.0608	3.0661	3.0915	3.0963	3.1190	3.1190	3.1233	3.1102	3.0963	3.0866	3.0765

util living area

	0.9359	0.9087	0.8616	0.7588	0.6148	0.4553	0.3405	0.3863	0.5943	0.8096	0.9072	0.9419 (86)
MIT	19.2143	19.4914	19.8947	20.4045	20.7550	20.9293	20.9785	20.9681	20.8371	20.3728	19.7277	19.1713 (87)
Th 2	20.0954	20.0975	20.0996	20.1096	20.1115	20.1202	20.1202	20.1218	20.1168	20.1115	20.1077	20.1037 (88)
util rest of house												
	0.9272	0.8967	0.8435	0.7293	0.5718	0.3998	0.2755	0.3174	0.5361	0.7787	0.8930	0.9339 (89)
MIT 2	18.0186	18.3650	18.8646	19.4824	19.8799	20.0658	20.1081	20.1028	19.9807	19.4624	18.6731	17.9703 (90)
Living area fraction										fLA = Living area / (4) =		0.6328 (91)
MIT	18.7752	19.0778	19.5164	20.0659	20.4336	20.6122	20.6589	20.6504	20.5226	20.0385	19.3404	18.7303 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7752	19.0778	19.5164	20.0659	20.4336	20.6122	20.6589	20.6504	20.5226	20.0385	19.3404	18.7303 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9116	0.8808	0.8304	0.7278	0.5879	0.4313	0.3156	0.3593	0.5637	0.7759	0.8787	0.9189	(94)
Useful gains	387.5662	422.2916	438.3495	436.6877	384.8080	282.4684	196.3366	203.3610	285.6080	346.1681	364.5897	375.6150	(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	736.5915	719.5653	658.9214	558.3840	435.7471	296.7525	200.3385	209.3688	318.3317	470.9158	613.5577	731.8712	(97)
Space heating kWh	259.6749	199.7679	164.1055	87.6214	37.8987	0.0000	0.0000	0.0000	0.0000	92.8123	179.2569	265.0546	(98a)
Space heating requirement - total per year (kWh/year)												1286.1921	
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	259.6749	199.7679	164.1055	87.6214	37.8987	0.0000	0.0000	0.0000	0.0000	92.8123	179.2569	265.0546	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1286.1921	
Space heating per m2											(98c) / (4) =	24.9117	(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	259.6749	199.7679	164.1055	87.6214	37.8987	0.0000	0.0000	0.0000	0.0000	92.8123	179.2569	265.0546	(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)	281.0334	216.1990	177.6033	94.8283	41.0159	0.0000	0.0000	0.0000	0.0000	100.4462	194.0010	286.8556	(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	84.9529	84.6516	84.0940	83.0720	81.8114	80.3000	80.3000	80.3000	80.3000	83.1509	84.3962	85.0176	(217)
Fuel for water heating, kWh/month	234.2213	208.1046	223.2793	200.3016	196.2470	179.1241	176.7630	185.0456	188.2220	203.3187	210.9409	231.7496	(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	1391.9828	(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	2437.3177	(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	3618.2993 (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	1391.9828	0.2100	292.3164	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2437.3177	0.2100	511.8367	(264)
Space and water heating			804.1531	(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			779.3474	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.0900	(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	1391.9828	1.1300	1572.9406	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2437.3177	1.1300	2754.1691	(278)
Space and water heating			4327.1097	(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			4192.5585	(286)
Target Primary Energy Rate (TPER)			81.2000	(287)

Full SAP Calculation Printout

Property Reference	Flat 203 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 203 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	85 B	DER	11.86	TER	12.50
Environmental	90 B	% DER < TER			5.12
CO_2 Emissions (t/year)	0.8	DFEE	29.56	TFEE	29.79
Compliance Check	See BREL	% DFEE < TFEE			0.79
% DPER < TPER	-4.28	DPER	69.36	TPER	66.51

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.0000 (1b)	x	2.5200 (2b)	=	186.4800	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 74.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.4800	(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)			19.9200	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)

External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9800 (29a)
Total net area of external elements Aum(A, m2)			68.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9691		(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			74.0000			40.0000	2960.0000 (32d)
Party Ceiling 1			74.0000			30.0000	2220.0000 (32b)
Internal Wall 1			88.7000			9.0000	798.3000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7446.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.6254 (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	0.4430	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)	54.4400	0.0700	3.8108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9369 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	39.9060 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.8596	13.6808	13.5019	12.6077	12.4288	11.5346	11.5346	11.3558	11.8923	12.4288	12.7865	13.1442	(38)
Heat transfer coeff	53.7656	53.5868	53.4079	52.5137	52.3348	51.4406	51.4406	51.2618	51.7983	52.3348	52.6925	53.0502	(39)
Average = Sum(39)m / 12 =												52.4690	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7266	0.7241	0.7217	0.7096	0.7072	0.6951	0.6951	0.6927	0.7000	0.7072	0.7121	0.7169	(40)
HLP (average)												0.7090	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3392 (42)
Hot water usage for mixer showers	63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972 (42a)
Hot water usage for baths	28.8470	28.4185	27.8152	26.7029	25.8699	24.9463	24.4474	25.0465	25.6988	26.6871	27.8224	28.7494 (42b)
Hot water usage for other uses	40.6165	39.1395	37.6626	36.1856	34.7087	33.2317	33.2317	34.7087	36.1856	37.6626	39.1395	40.6165 (42c)
Average daily hot water use (litres/day)												122.1596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.9037	130.0450	126.5754	121.3280	117.0565	112.4683	110.7260	114.1808	117.8214	122.6355	127.9629	132.5632	(44)
Energy conte	210.4870	185.1823	194.5417	166.0920	157.5805	138.2929	133.9135	141.3797	145.2856	166.4152	182.3067	207.5619	(45)
Energy content (annual)										Total = Sum(45)m =		2029.0391	
Distribution loss (46)m = 0.15 x (45)m	31.5731	27.7773	29.1813	24.9138	23.6371	20.7439	20.0870	21.2070	21.7928	24.9623	27.3460	31.1343	(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	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(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	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(64)
										Total per year (kWh/year) = Sum(64)m =		2629.0391	(64)
12Total per year (kWh/year)												2629	(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	82.7267	73.0800	77.4249	67.5543	65.1352	58.3112	57.2660	59.7485	60.6362	68.0728	72.9457	81.7540	(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	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.1289	115.2856	104.1289	107.5999	104.1289	107.5999	104.1289	104.1289	107.5999	104.1289	107.5999	104.1289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(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)												
	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678 (71)
Water heating gains (Table 5)												
	111.1918	108.7500	104.0657	93.8255	87.5474	80.9877	76.9704	80.3071	84.2170	91.4957	101.3135	109.8845 (72)
Total internal gains												
	482.8559	493.7130	472.4736	454.2117	429.9551	410.2315	393.6342	394.8286	407.6079	425.9083	453.7046	472.4396 (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	635.3827	760.7173	856.9108	962.5798	1028.6070	1017.4146	973.6716	905.5442	834.6538	726.1576	637.7068	602.1230 (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	38.4709	38.5993	38.7286	39.3880	39.5226	40.2097	40.2097	40.3500	39.9320	39.5226	39.2544	38.9897	
alpha	3.5647	3.5733	3.5819	3.6259	3.6348	3.6806	3.6806	3.6900	3.6621	3.6348	3.6170	3.5993	
util living area													
	0.8926	0.8276	0.7406	0.6018	0.4562	0.3201	0.2316	0.2591	0.4170	0.6602	0.8341	0.9053	(86)
MIT	19.9366	20.2496	20.5496	20.8183	20.9435	20.9885	20.9974	20.9960	20.9697	20.7898	20.3515	19.8827	(87)
Th 2	20.3174	20.3196	20.3217	20.3323	20.3345	20.3451	20.3451	20.3473	20.3409	20.3345	20.3302	20.3259	(88)
util rest of house													
	0.8818	0.8124	0.7201	0.5759	0.4266	0.2883	0.1975	0.2228	0.3799	0.6300	0.8169	0.8956	(89)
MIT 2	19.0760	19.4595	19.8211	20.1414	20.2803	20.3358	20.3435	20.3447	20.3149	20.1183	19.5989	19.0160	(90)
Living area fraction										fLA = Living area / (4) =		0.5274	(91)
MIT	19.5299	19.8762	20.2053	20.4984	20.6301	20.6801	20.6884	20.6882	20.6603	20.4725	19.9958	19.4732	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3799	19.7262	20.0553	20.3484	20.4801	20.5301	20.5384	20.5382	20.5103	20.3225	19.8458	19.3232	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8649	0.7980	0.7117	0.5766	0.4332	0.2973	0.2076	0.2334	0.3895	0.6294	0.8032	0.8788	(94)
Useful gains	549.5166	607.0399	609.8572	555.0035	445.5825	302.5028	202.0945	211.3638	325.1088	457.0657	512.2207	529.1639	(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													
	810.7799	794.4898	723.9629	601.1983	459.5037	305.0477	202.5912	212.1318	332.0408	508.8256	671.6098	802.2867	(97)
Space heating kWh													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(98a)
Space heating requirement - total per year (kWh/year)												805.3315	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												805.3315	
Space heating per m2											(98c) / (4) =	10.8829	(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	483.5417	380.6605	389.5894	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9751	0.9864	0.9817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	471.4874	375.4933	382.4620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1140.4963	1091.7621	1013.3195	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	481.6864	532.9040	469.3580	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	120.4216	133.2260	117.3395	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												370.9871 (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)	4.0300 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(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)													
	217.1843	140.7445	94.8543	37.1623	11.5724	0.0000	0.0000	0.0000	0.0000	43.0273	128.2237	227.0429	(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													
	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(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													
	292.1184	258.3349	274.3024	240.6782	233.0049	209.6179	206.5614	214.9035	217.4309	242.8761	258.7952	288.8500	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	29.8813	33.0586	29.1165	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.0759	21.7460	24.0759	23.2993	24.0759	23.2993	24.0759	24.0759	23.2993	24.0759	23.2993	24.0759	(231)
Lighting	19.1300	15.3468	13.8181	10.1237	7.8198	6.3889	7.1335	9.2724	12.0440	15.8023	17.8487	19.6617	(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	899.8118 (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	2937.4739 (219)
Space cooling fuel	92.0564 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	197.4749 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	283.4749 (231)
Electricity for lighting (calculated in Appendix L)	154.3899 (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	4367.2067 (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	899.8118	0.2100	188.9605	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2937.4739	0.2100	616.8695	(264)
Space and water heating			805.8300	(265)
Space cooling	92.0564	0.1142	10.5163	(266)
Pumps, fans and electric keep-hot	283.4749	0.1387	39.3215	(267)

Energy for lighting	154.3899	0.1443	22.2832 (268)
Total CO2, kg/year			877.9510 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.8600 (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	899.8118	1.1300	1016.7873	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2937.4739	1.1300	3319.3455	(278)
Space and water heating			4336.1328	(279)
Space cooling	92.0564	1.4210	130.8131	(280)
Pumps, fans and electric keep-hot	283.4749	1.5128	428.8408	(281)
Energy for lighting	154.3899	1.5338	236.8084	(282)
Total Primary energy kWh/year			5132.5950	(286)
Dwelling Primary energy Rate (DPER)			69.3600	(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	74.0000 (1b)	x	2.5200 (2b)	=	186.4800	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.4800	(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) =	0.1609	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4109	(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) =	0.3184	(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	0.4060	0.3980	0.3901	0.3503	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3742	(22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5458	0.5458	0.5434	0.5507	0.5586	0.5642	0.5700	(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)			16.5100	1.1450	18.9046			(27)
External Wall 1	68.5900	18.5100	50.0800	0.1800	9.0144			(29a)
Total net area of external elements Aum(A, m2)			68.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9190			(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 110.6254 (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)	54.4400	0.0700	3.8108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8811 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 37.8001 (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	35.8410	35.6440	35.4510	34.5443	34.3746	33.5849	33.5849	33.4387	33.8891	34.3746	34.7178	35.0766	(38)
Heat transfer coeff	73.6411	73.4441	73.2511	72.3443	72.1747	71.3850	71.3850	71.2387	71.6892	72.1747	72.5179	72.8767	(39)

Average = Sum(39)m / 12 = 72.3435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9951	0.9925	0.9899	0.9776	0.9753	0.9647	0.9647	0.9627	0.9688	0.9753	0.9800	0.9848	(40)
HLP (average)												0.9776	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)

Hot water usage for mixer showers

63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972	(42a)

Hot water usage for baths

27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120	(42b)

Hot water usage for other uses

38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857	(42c)

Average daily hot water use (litres/day) 118.9761 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949	(44)
Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314	(45)

Energy content (annual) Total = Sum(45)m = 1976.1681

Distribution loss (46)m = 0.15 x (45)m	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197	(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

	255.9453	226.3996	240.4688	211.1025	204.4619	184.0312	181.3845	188.6391	190.7852	213.0080	226.8518	253.0903	(62)
WWHRS	-29.0022	-25.6498	-26.8590	-22.2403	-20.7272	-17.7364	-16.6250	-17.6791	-18.3508	-21.6335	-24.5082	-28.4652	(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	226.9430	200.7498	213.6098	188.8621	183.7347	166.2948	164.7595	170.9601	172.4344	191.3745	202.3436	224.6251	(64)

Total per year (kWh/year) = Sum(64)m = 2306.6914 (64)

12Total per year (kWh/year) 2307 (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

	80.8977	71.4806	75.7518	66.1231	63.7795	57.1219	56.1062	58.5184	59.3676	66.6211	71.3597	79.9484	(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	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.1276	115.2841	104.1276	107.5985	104.1276	107.5985	104.1276	104.1276	107.5985	104.1276	107.5985	104.1276	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(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)	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	(71)
Water heating gains (Table 5)	108.7335	106.3700	101.8169	91.8376	85.7251	79.3359	75.4116	78.6538	82.4550	89.5444	99.1107	107.4575	(72)

Total internal gains

	480.3962	491.3315	470.2234	452.2224	428.1315	408.5782	392.0740	393.1739	405.8445	423.9557	451.5004	470.0113 (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	1.1700	11.2829	0.6300	0.7000	0.7700	4.0344 (75)
Southeast	9.3100	36.7938	0.6300	0.7000	0.7700	104.6879 (77)
Southwest	1.4100	36.7938	0.6300	0.7000	0.7700	15.8550 (79)
Northwest	4.6200	11.2829	0.6300	0.7000	0.7700	15.9307 (81)

Solar gains	140.5081	245.9688	354.1600	468.3465	551.5362	559.4018	534.3899	470.5144	393.4183	276.5973	169.5039	119.4642 (83)
Total gains	620.9043	737.3003	824.3835	920.5689	979.6676	967.9800	926.4639	863.6883	799.2628	700.5530	621.0043	589.4754 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.8791	30.9619	31.0435	31.4325	31.5064	31.8550	31.8550	31.9204	31.7198	31.5064	31.3573	31.2029	
alpha	3.0586	3.0641	3.0696	3.0955	3.1004	3.1237	3.1237	3.1280	3.1147	3.1004	3.0905	3.0802	
util living area	0.9347	0.8962	0.8402	0.7365	0.6004	0.4470	0.3313	0.3678	0.5574	0.7816	0.9003	0.9425	(86)
MIT	19.2285	19.5758	19.9903	20.4583	20.7719	20.9333	20.9803	20.9724	20.8648	20.4422	19.7692	19.1694	(87)
Th 2	20.0874	20.0896	20.0918	20.1020	20.1039	20.1129	20.1129	20.1145	20.1094	20.1039	20.1001	20.0960	(88)
util rest of house	0.9258	0.8829	0.8202	0.7057	0.5571	0.3917	0.2673	0.3011	0.4997	0.7481	0.8853	0.9345	(89)
MIT 2	18.0300	18.4619	18.9717	19.5360	19.8898	20.0620	20.1019	20.0984	19.9984	19.5335	18.7174	17.9619	(90)
Living area fraction										fLA = Living area / (4) =		0.5274	(91)
MIT	18.6621	19.0494	19.5089	20.0225	20.3550	20.5215	20.5652	20.5594	20.4554	20.0128	19.2721	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6621	19.0494	19.5089	20.0225	20.3550	20.5215	20.5652	20.5594	20.4554	20.0128	19.2721	18.5988	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9085	0.8651	0.8059	0.7028	0.5696	0.4176	0.3003	0.3350	0.5228	0.7444	0.8689	0.9180	(94)
Useful gains	564.0808	637.8055	664.3875	647.0052	558.0581	404.2022	278.1767	289.3708	417.8508	521.4853	539.5796	541.1539	(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	1057.6434	1039.1904	952.9189	804.6493	624.6754	422.7079	283.0549	296.3086	455.6100	679.3662	882.6959	1049.3339	(97)
Space heating kWh	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(98a)
Space heating requirement - total per year (kWh/year)												1757.2686	
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	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1757.2686	
Space heating per m2										(98c) / (4) =		23.7469	(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	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(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)	397.4141	291.9163	232.3239	122.8396	53.6399	0.0000	0.0000	0.0000	0.0000	127.1249	267.3634	409.1839	(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	226.9430	200.7498	213.6098	188.8621	183.7347	166.2948	164.7595	170.9601	172.4344	191.3745	202.3436	224.6251	(64)

Efficiency of water heater												80.3000 (216)
(217)m	85.4063	85.0150	84.3920	83.3259	81.9849	80.3000	80.3000	80.3000	80.3000	83.3674	84.8102	85.4878 (217)
Fuel for water heating, kWh/month												
	265.7218	236.1346	253.1161	226.6548	224.1079	207.0919	205.1799	212.9017	214.7378	229.5557	238.5840	262.7569 (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	21.6356	17.3569	15.6280	11.4497	8.8441	7.2257	8.0679	10.4869	13.6215	17.8721	20.1865	22.2370 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.3754	-24.5457	-37.4855	-44.8657	-50.7916	-48.2957	-47.7057	-43.8293	-37.4345	-29.2341	-18.5129	-13.9924 (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	-5.2947	-11.4338	-23.2891	-35.8243	-48.2107	-48.7528	-48.1818	-40.4091	-29.1150	-16.6263	-7.1556	-4.1654 (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	1901.8058 (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	2776.5430 (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)	174.6121 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-731.5271 (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	4207.4339 (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	1901.8058	0.2100	399.3792	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2776.5430	0.2100	583.0740	(264)
Space and water heating			982.4533	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	174.6121	0.1443	25.2019	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-413.0685	0.1333	-55.0708	
PV Unit electricity exported	-318.4586	0.1252	-39.8716	
Total			-94.9424	(269)
Total CO2, kg/year			924.6420	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5000	(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	1901.8058	1.1300	2149.0406	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2776.5430	1.1300	3137.4936	(278)
Space and water heating			5286.5342	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	174.6121	1.5338	267.8258	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-413.0685	1.4927	-616.5711	
PV Unit electricity exported	-318.4586	0.4595	-146.3455	
Total			-762.9166	(283)
Total Primary energy kWh/year			4921.5443	(286)
Target Primary Energy Rate (TPER)			66.5100	(287)

Full SAP Calculation Printout

Property Reference	Flat 204 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 204 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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000 (1b)	x	2.5800 (2b)	=	134.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	134.1600	(5)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			15.1600	0.9152	13.8748			(27)
Window (Uw = 0.95)			0.9000	0.9152	0.8237			(27)
Door			1.8900	0.8000	1.5120			(26)

Heatloss Floor 1			52.0000	0.1200	6.2400	30.0000	1560.0000 (28b)
External Wall 1	50.3100	17.9500	32.3600	0.1500	4.8540	14.0000	453.0400 (29a)
Total net area of external elements Aum(A, m2)			102.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.3045		(33)
Party Wall 1			23.2500	0.0000	0.0000	20.0000	465.0000 (32)
Party Ceiling 1			52.0000			30.0000	1560.0000 (32b)
Internal Wall 1			46.5400			9.0000	418.8600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4456.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.7096 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	19.5000	0.0700	1.3650
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.4430	2.5251
E20 Exposed floor (normal)	19.5000	0.1250	2.4375
E16 Corner (normal)	7.7400	0.0900	0.6966
E17 Corner (inverted – internal area greater than external area)	2.5800	-0.0900	-0.2322
E18 Party wall between dwellings	5.1600	0.0600	0.3096
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	12.3200	0.1600	1.9712
E1 Steel lintel with perforated steel base plate	8.0400	0.0500	0.4020
E3 Sill	7.1400	0.0500	0.3570
E4 Jamb	25.4000	0.0500	1.2700

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1018 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.4063 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.9711	9.8424	9.7137	9.0704	8.9417	8.2984	8.2984	8.1697	8.5557	8.9417	9.1991	9.4564	(38)
Heat transfer coeff	48.3773	48.2487	48.1200	47.4766	47.3480	46.7046	46.7046	46.5760	46.9620	47.3480	47.6053	47.8627	(39)

Average = Sum(39)m / 12 = 47.4445

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9303	0.9279	0.9254	0.9130	0.9105	0.8982	0.8982	0.8957	0.9031	0.9105	0.9155	0.9204	(40)
HLP (average)												0.9124	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
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)

---
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	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)

---

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)

---

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	

---

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													
	77.0119	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)

---

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)

---

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 205 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 205 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	15.35	TER	16.13
Environmental	89 B	% DER < TER			4.84
CO_2 Emissions (t/year)	0.72	DFEE	37.80	TFEE	37.14
Compliance Check	See BREL	% DFEE < TFEE			-1.78
% DPER < TPER	-2.07	DPER	88.22	TPER	86.43

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000	(1b)	x 2.5800	(2b) =	134.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		134.1600	(5)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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	74.4300	20.7900	53.6400	0.1500	8.0460	14.0000	750.9600 (29a)
Total net area of external elements Aum(A, m2)			74.4300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8557		(33)
Party Wall 1			9.0300	0.0000	0.0000	20.0000	180.6000 (32)
Party Floor 1			52.0000			40.0000	2080.0000 (32d)
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) = 5047.5700 (34)
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)	57.7000	0.0700	4.0390
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.4430	1.9049
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)	7.0000	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

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9803 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.8360 (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	45.8071	45.6784	45.5497	44.9064	44.7777	44.1344	44.1344	44.0057	44.3917	44.7777	45.0350	45.2924	(39)

Average = Sum(39)m / 12 = 44.8742

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8809	0.8784	0.8760	0.8636	0.8611	0.8487	0.8487	0.8463	0.8537	0.8611	0.8661	0.8710	(40)
HLP (average)												0.8630	
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	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)

---
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	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												
	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	30.6089	30.6951	30.7818	31.2228	31.3125	31.7690	31.7690	31.8618	31.5848	31.3125	31.1336	30.9567	
alpha	3.0406	3.0463	3.0521	3.0815	3.0875	3.1179	3.1179	3.1241	3.1057	3.0875	3.0756	3.0638	
util living area													
	0.9033	0.8570	0.7852	0.6545	0.5032	0.3586	0.2636	0.3006	0.4839	0.7217	0.8596	0.9128	(86)
MIT	19.4525	19.7791	20.1805	20.6130	20.8591	20.9638	20.9896	20.9844	20.9082	20.5593	19.9559	19.3990	(87)
Th 2	20.1838	20.1859	20.1880	20.1986	20.2007	20.2113	20.2113	20.2134	20.2070	20.2007	20.1964	20.1922	(88)
util rest of house													
	0.8926	0.8423	0.7645	0.6255	0.4670	0.3172	0.2175	0.2510	0.4361	0.6892	0.8427	0.9030	(89)
MIT 2	18.3818	18.7853	19.2749	19.7916	20.0664	20.1825	20.2050	20.2035	20.1291	19.7453	19.0191	18.3213	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	19.0463	19.4020	19.8369	20.3013	20.5584	20.6673	20.6919	20.6881	20.6126	20.2504	19.6005	18.9901	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8963	19.2520	19.6869	20.1513	20.4084	20.5173	20.5419	20.5381	20.4626	20.1004	19.4505	18.8401	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8724	0.8231	0.7505	0.6237	0.4766	0.3334	0.2369	0.2716	0.4518	0.6849	0.8248	0.8833	(94)
Useful gains	399.9761	440.7393	454.0248	434.7035	364.4219	255.0562	172.4423	179.7436	266.7649	347.8486	374.8531	386.4090	(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													
	668.6125	655.5768	600.6574	505.2570	389.9404	261.1584	173.9742	182.0991	282.4455	425.4069	556.2041	663.0836	(97)
Space heating kWh													
	199.8655	144.3708	109.0947	50.7985	18.9857	0.0000	0.0000	0.0000	0.0000	57.7034	130.5728	205.8459	(98a)
Space heating requirement - total per year (kWh/year)												917.2373	
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													
	199.8655	144.3708	109.0947	50.7985	18.9857	0.0000	0.0000	0.0000	0.0000	57.7034	130.5728	205.8459	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												917.2373	
Space heating per m2											(98c) / (4) =	17.6392	(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													
	199.8655	144.3708	109.0947	50.7985	18.9857	0.0000	0.0000	0.0000	0.0000	57.7034	130.5728	205.8459	(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)													
	223.3134	161.3081	121.8935	56.7581	21.2131	0.0000	0.0000	0.0000	0.0000	64.4731	145.8914	229.9954	(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 1024.8461 (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 3926.6769 (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	1024.8461	0.2100	215.2177	(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			743.8146	(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			797.9436	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.3500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1024.8461	1.1300	1158.0761	(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			4002.4310	(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			4587.2766	(286)
Dwelling Primary energy Rate (DPER)			88.2200	(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)
External Wall 1	74.4300	13.0000	61.4300	0.1800	11.0574			(29a)
Total net area of external elements Aum(A, m2)			74.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.6688			(33)
Party Wall 1			9.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 107.0687 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	57.7000	0.0700	4.0390
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.0200	0.0860
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)	7.0000	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

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.1614 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 32.8302 (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	58.4088	58.2751	58.1441	57.5287	57.4136	56.8776	56.8776	56.7783	57.0841	57.4136	57.6465	57.8900	(39)
Average = Sum(39)m / 12 =												57.5282	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1232	1.1207	1.1182	1.1063	1.1041	1.0938	1.0938	1.0919	1.0978	1.1041	1.1086	1.1133	(40)
HLP (average)												1.1063	
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)

	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)

---
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	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	26.4780	26.5387	26.5985	26.8830	26.9370	27.1908	27.1908	27.2383	27.0925	26.9370	26.8281	26.7153	

alpha	2.7652	2.7692	2.7732	2.7922	2.7958	2.8127	2.8127	2.8159	2.8062	2.7958	2.7885	2.7810	
util living area	0.9357	0.9086	0.8651	0.7750	0.6463	0.4937	0.3745	0.4188	0.6186	0.8169	0.9084	0.9417	(86)
MIT	18.8644	19.1736	19.6191	20.1896	20.6231	20.8731	20.9569	20.9403	20.7533	20.1881	19.4447	18.8129	(87)
Th 2	19.9819	19.9840	19.9860	19.9957	19.9975	20.0059	20.0059	20.0075	20.0027	19.9975	19.9938	19.9900	(88)
util rest of house	0.9266	0.8960	0.8463	0.7445	0.5998	0.4295	0.2961	0.3373	0.5548	0.7845	0.8937	0.9334	(89)
MIT 2	17.5114	17.8980	18.4511	19.1454	19.6426	19.9095	19.9824	19.9729	19.7986	19.1631	18.2507	17.4521	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	18.3510	18.6896	19.1759	19.7934	20.2510	20.5075	20.5872	20.5733	20.3911	19.7992	18.9917	18.2966	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3510	18.6896	19.1759	19.7934	20.2510	20.5075	20.5872	20.5733	20.3911	19.7992	18.9917	18.2966	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9080	0.8765	0.8290	0.7377	0.6121	0.4627	0.3426	0.3846	0.5808	0.7773	0.8758	0.9155	(94)
Useful gains	400.5250	441.2593	459.8728	460.5281	412.2723	310.1211	218.6615	225.5893	309.2829	365.9457	379.4036	387.1601	(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	820.7050	803.5896	737.0316	626.6844	490.9459	336.0053	226.7803	236.9511	359.1206	528.1598	685.5152	816.0528	(97)
Space heating kWh	312.6139	243.4860	206.2061	119.6325	58.5332	0.0000	0.0000	0.0000	0.0000	120.6874	220.4003	319.0962	(98a)
Space heating requirement - total per year (kWh/year)												1600.6556	
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	312.6139	243.4860	206.2061	119.6325	58.5332	0.0000	0.0000	0.0000	0.0000	120.6874	220.4003	319.0962	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1600.6556	
Space heating per m2											(98c) / (4) =	30.7818	(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	312.6139	243.4860	206.2061	119.6325	58.5332	0.0000	0.0000	0.0000	0.0000	120.6874	220.4003	319.0962	(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)	338.3268	263.5130	223.1668	129.4724	63.3476	0.0000	0.0000	0.0000	0.0000	130.6140	238.5285	345.3422	(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	85.3397	85.0698	84.5773	83.6790	82.4250	80.3000	80.3000	80.3000	80.3000	83.6665	84.8348	85.4029	(217)
Fuel for water heating, kWh/month	233.7548	207.6065	222.5584	199.5310	195.4545	179.7386	177.3695	185.6805	188.8679	202.5499	210.3711	231.2910	(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												1732.3113	(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												2434.7739	(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	3868.1741 (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	1732.3113	0.2100	363.7854	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2434.7739	0.2100	511.3025	(264)
Space and water heating			875.0879	(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			838.9167	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.1300	(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	1732.3113	1.1300	1957.5117	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2434.7739	1.1300	2751.2946	(278)
Space and water heating			4708.8063	(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			4494.2152	(286)
Target Primary Energy Rate (TPER)			86.4300	(287)

Full SAP Calculation Printout

Property Reference	Flat 301 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 301 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	15.16	TER	16.42
Environmental	88 B	% DER < TER			7.67
CO_2 Emissions (t/year)	0.91	DFEE	41.97	TFEE	46.76
Compliance Check	See BREL	% DFEE < TFEE			10.23
% DPER < TPER	0.34	DPER	86.56	TPER	86.85

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

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.0000 (1b)	x	2.4000 (2b)	=	160.8000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 67.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	160.8000	(5)

---

2. Ventilation rate

---

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

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			23.4600	0.9152	21.4711			(27)
Window (Uw = 0.95)			2.4000	0.9152	2.1965			(27)
Door			1.8900	0.8000	1.5120			(26)

External Wall 1	66.4800	27.7500	38.7300	0.1500	5.8095	14.0000	542.2200 (29a)
External Roof 1	67.0000		67.0000	0.1000	6.7000	9.0000	603.0000 (30)
Total net area of external elements Aum(A, m2)			133.4800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.6891		(33)
Party Wall 1			12.5500	0.0000	0.0000	20.0000	251.0000 (32)
Party Floor 1			67.0000			40.0000	2680.0000 (32d)
Internal Wall 1			97.6300			9.0000	878.6700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4954.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		73.9536 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	27.7000	0.0700	1.9390
E16 Corner (normal)	7.2000	0.0900	0.6480
E17 Corner (inverted – internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	2.4000	0.0600	0.1440
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.2300	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	13.1500	0.0500	0.6575
E3 Sill	12.2500	0.0500	0.6125
E4 Jamb	36.6000	0.0500	1.8300
P4 Party wall - Roof (insulation at ceiling level)	5.2300	0.1200	0.6276
E15 Flat roof with parapet	27.7000	0.3000	8.3100

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.5526 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.2417 (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	11.9510	11.7968	11.6426	10.8715	10.7173	9.9462	9.9462	9.7920	10.2546	10.7173	11.0257	11.3341	(38)
Heat transfer coeff	64.1927	64.0385	63.8843	63.1132	62.9590	62.1879	62.1879	62.0337	62.4963	62.9590	63.2674	63.5759	(39)
Average = Sum(39)m / 12 =												63.0747	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9581	0.9558	0.9535	0.9420	0.9397	0.9282	0.9282	0.9259	0.9328	0.9397	0.9443	0.9489	(40)
HLP (average)												0.9414	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1711 (42)
Hot water usage for mixer showers	60.6226	59.7116	58.3840	55.8440	53.9695	51.8791	50.6909	52.0084	53.4526	55.6971	58.2917	60.3904 (42a)
Hot water usage for baths	26.1929	25.8039	25.2561	24.2461	23.4898	22.6512	22.1982	22.7422	23.3344	24.2318	25.2626	26.1044 (42b)
Hot water usage for other uses	36.8647	35.5242	34.1837	32.8431	31.5026	30.1621	30.1621	31.5026	32.8431	34.1837	35.5242	36.8647 (42c)
Average daily hot water use (litres/day)												113.6904 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	123.6803	121.0397	117.8238	112.9332	108.9619	104.6923	103.0511	106.2531	109.6302	114.1126	119.0786	123.3595	(44)
Energy conte	195.8794	172.3590	181.0909	154.5999	146.6836	128.7314	124.6314	131.5636	135.1850	154.8497	169.6492	193.1512	(45)
Energy content (annual)										Total = Sum(45)m =		1888.3742	
Distribution loss (46)m = 0.15 x (45)m	29.3819	25.8538	27.1636	23.1900	22.0025	19.3097	18.6947	19.7345	20.2777	23.2275	25.4474	28.9727	(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	246.8383	218.3864	232.0498	203.9150	197.6425	178.0465	175.5903	182.5225	184.5001	205.8086	218.9643	244.1101	(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	246.8383	218.3864	232.0498	203.9150	197.6425	178.0465	175.5903	182.5225	184.5001	205.8086	218.9643	244.1101	(64)
										Total per year (kWh/year) = Sum(64)m =		2488.3742	(64)
12Total per year (kWh/year)												2488	(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	77.8696	68.8162	72.9524	63.7332	61.5120	55.1320	54.1797	56.4846	57.2778	64.2272	68.7371	76.9625	(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	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	95.9323	106.2108	95.9323	99.1300	95.9323	99.1300	95.9323	95.9323	99.1300	95.9323	99.1300	95.9323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	190.1965	192.1702	187.1966	176.6086	163.2431	150.6814	142.2895	140.3158	145.2893	155.8774	169.2429	181.8045	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	(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)												
	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459 (71)
Water heating gains (Table 5)												
	104.6635	102.4051	98.0544	88.5184	82.6775	76.5722	72.8221	75.9202	79.5525	86.3269	95.4682	103.4442 (72)
Total internal gains												
	449.3595	459.3532	439.7505	422.8243	400.4201	381.9509	366.6111	367.7355	379.5391	396.7038	422.4084	439.7483 (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	11.8800	11.2829	0.4700	0.7000	0.7700	30.5610	(75)
Southwest	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100	(79)
Northwest	9.6000	11.2829	0.4700	0.7000	0.7700	24.6958	(81)
Southwest	2.4000	36.7938	0.4700	0.7000	0.7700	20.1333	(79)

Solar gains	92.0001	175.0643	288.2823	438.9111	566.2030	594.9163	559.9097	459.9285	339.6535	206.6281	113.5374	76.5701 (83)
Total gains	541.3596	634.4175	728.0328	861.7354	966.6231	976.8672	926.5208	827.6640	719.1926	603.3319	535.9457	516.3184 (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	21.4410	21.4927	21.5445	21.8078	21.8612	22.1322	22.1322	22.1873	22.0230	21.8612	21.7546	21.6491	
alpha	2.4294	2.4328	2.4363	2.4539	2.4574	2.4755	2.4755	2.4792	2.4682	2.4574	2.4503	2.4433	
util living area													
	0.8959	0.8545	0.7886	0.6664	0.5211	0.3801	0.2850	0.3282	0.5178	0.7392	0.8583	0.9047	(86)
MIT	18.7000	19.0825	19.6171	20.2526	20.6769	20.8939	20.9621	20.9456	20.7668	20.1753	19.3465	18.6358	(87)
Th 2	20.1184	20.1203	20.1223	20.1320	20.1339	20.1436	20.1436	20.1456	20.1397	20.1339	20.1300	20.1261	(88)
util rest of house													
	0.8855	0.8407	0.7692	0.6384	0.4843	0.3351	0.2326	0.2720	0.4680	0.7089	0.8425	0.8951	(89)
MIT 2	17.4233	17.8993	18.5592	19.3280	19.8154	20.0550	20.1190	20.1086	19.9317	19.2594	18.2441	17.3479	(90)
Living area fraction										fLA = Living area / (4) =		0.7145	(91)
MIT	18.3355	18.7446	19.3151	19.9886	20.4309	20.6543	20.7213	20.7066	20.5284	19.9138	19.0317	18.2681	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1855	18.5946	19.1651	19.8386	20.2809	20.5043	20.5713	20.5566	20.3784	19.7638	18.8817	18.1181	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8573	0.8125	0.7454	0.6283	0.4908	0.3543	0.2591	0.2994	0.4823	0.6947	0.8158	0.8676	(94)
Useful gains	464.0886	515.4474	542.6671	541.4474	474.3882	346.1459	240.0359	247.8238	346.8445	419.1374	437.2019	447.9567	(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													
	891.3460	876.9837	809.0983	690.3724	540.2450	367.1790	246.9696	257.8507	392.3769	576.9405	745.3989	884.8536	(97)
Space heating kWh													
	317.8795	242.9524	198.2248	107.2260	48.9974	0.0000	0.0000	0.0000	0.0000	117.4055	221.9019	325.0513	(98a)
Space heating requirement - total per year (kWh/year)												1579.6388	
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													
	317.8795	242.9524	198.2248	107.2260	48.9974	0.0000	0.0000	0.0000	0.0000	117.4055	221.9019	325.0513	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1579.6388	
Space heating per m2											(98c) / (4) =	23.5767	(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													
	317.8795	242.9524	198.2248	107.2260	48.9974	0.0000	0.0000	0.0000	0.0000	117.4055	221.9019	325.0513	(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)													
	355.1727	271.4552	221.4802	119.8056	54.7457	0.0000	0.0000	0.0000	0.0000	131.1793	247.9350	363.1858	(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

246.8383	218.3864	232.0498	203.9150	197.6425	178.0465	175.5903	182.5225	184.5001	205.8086	218.9643	244.1101 (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

275.7970	244.0071	259.2735	227.8380	220.8296	198.9346	196.1903	203.9357	206.1453	229.9537	244.6528	272.7487 (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 23.8323	21.5260	23.8323	23.0636	23.8323	23.0636	23.8323	23.8323	23.0636	23.8323	23.0636	23.8323 (231)
Lighting 19.2719	15.4606	13.9206	10.1988	7.8778	6.4363	7.1864	9.3412	12.1333	15.9195	17.9811	19.8075 (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	1764.9595 (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	2780.3064 (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)	194.6066 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	280.6066 (231)
Electricity for lighting (calculated in Appendix L)	155.5350 (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	4981.4075 (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	1764.9595	0.2100	370.6415	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2780.3064	0.2100	583.8643	(264)
Space and water heating			954.5058	(265)
Pumps, fans and electric keep-hot	280.6066	0.1387	38.9236	(267)
Energy for lighting	155.5350	0.1443	22.4485	(268)
Total CO2, kg/year			1015.8779	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.1600	(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	1764.9595	1.1300	1994.4042	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2780.3064	1.1300	3141.7462	(278)
Space and water heating			5136.1505	(279)
Pumps, fans and electric keep-hot	280.6066	1.5128	424.5017	(281)
Energy for lighting	155.5350	1.5338	238.5648	(282)
Total Primary energy kWh/year			5799.2169	(286)
Dwelling Primary energy Rate (DPER)			86.5600	(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	67.0000 (1b)	x	2.4000 (2b)	=	160.8000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 67.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	160.8000	(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) =	0.1244 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3744 (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) =	0.2901 (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	0.3699	0.3627	0.3554	0.3192	0.3119	0.2756	0.2756	0.2684	0.2901	0.3119	0.3264	0.3409	(22b)
Effective ac	0.5684	0.5658	0.5632	0.5509	0.5486	0.5380	0.5380	0.5360	0.5421	0.5486	0.5533	0.5581	(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)			14.8700	1.1450	17.0267			(27)
External Wall 1	66.4800	16.7600	49.7200	0.1800	8.9496			(29a)
External Roof 1	67.0000		67.0000	0.1100	7.3700			(30)
Total net area of external elements Aum(A, m2)			133.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2363			(33)
Party Wall 1			12.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 73.9536 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E7	Party floor between dwellings (in blocks of flats)	27.7000	0.0700	1.9390
E16	Corner (normal)	7.2000	0.0900	0.6480
E17	Corner (inverted – internal area greater than external area)	2.4000	-0.0900	-0.2160
E18	Party wall between dwellings	2.4000	0.0600	0.1440
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	5.2300	0.0000	0.0000
E1	Steel lintel with perforated steel base plate	13.1500	0.0500	0.6575
E3	Sill	12.2500	0.0500	0.6125
E4	Jamb	36.6000	0.0500	1.8300
P4	Party wall - Roof (insulation at ceiling level)	5.2300	0.1200	0.6276
E15	Flat roof with parapet	27.7000	0.5600	15.5120

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.7546 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 56.9909 (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	30.1629	30.0219	29.8837	29.2346	29.1131	28.5478	28.5478	28.4431	28.7655	29.1131	29.3588	29.6157	(38)
Heat transfer coeff	87.1538	87.0128	86.8746	86.2255	86.1041	85.5387	85.5387	85.4340	85.7565	86.1041	86.3497	86.6066	(39)

Average = Sum(39)m / 12 = 86.2249

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3008	1.2987	1.2966	1.2869	1.2851	1.2767	1.2767	1.2751	1.2799	1.2851	1.2888	1.2926	(40)
HLP (average)												1.2869	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1711	(42)
Hot water usage for mixer showers													
	60.6226	59.7116	58.3840	55.8440	53.9695	51.8791	50.6909	52.0084	53.4526	55.6971	58.2917	60.3904	(42a)
Hot water usage for baths													
	26.1929	25.8039	25.2561	24.2461	23.4898	22.6512	22.1982	22.7422	23.3344	24.2318	25.2626	26.1044	(42b)
Hot water usage for other uses													
	36.8647	35.5242	34.1837	32.8431	31.5026	30.1621	30.1621	31.5026	32.8431	34.1837	35.5242	36.8647	(42c)
Average daily hot water use (litres/day)												113.6904	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	123.6803	121.0397	117.8238	112.9332	108.9619	104.6923	103.0511	106.2531	109.6302	114.1126	119.0786	123.3595	(44)
Energy conte	195.8794	172.3590	181.0909	154.5999	146.6836	128.7314	124.6314	131.5636	135.1850	154.8497	169.6492	193.1512	(45)
Energy content (annual)										Total = Sum(45)m =		1888.3742	
Distribution loss (46)m = 0.15 x (45)m													
	29.3819	25.8538	27.1636	23.1900	22.0025	19.3097	18.6947	19.7345	20.2777	23.2275	25.4474	28.9727	(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													
	246.8383	218.3864	232.0498	203.9150	197.6425	178.0465	175.5903	182.5225	184.5001	205.8086	218.9643	244.1101	(62)
WWHRS	-27.7141	-24.5106	-25.6661	-21.2525	-19.8066	-16.9487	-15.8867	-16.8939	-17.5357	-20.6727	-23.4197	-27.2009	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	219.1242	193.8758	206.3837	182.6624	177.8359	161.0978	159.7036	165.6286	166.9643	185.1359	195.5446	216.9092	(64)
										Total per year (kWh/year) = Sum(64)m =		2230.8660	(64)
12Total per year (kWh/year)												2231	(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													
	77.8696	68.8162	72.9524	63.7332	61.5120	55.1320	54.1797	56.4846	57.2778	64.2272	68.7371	76.9625	(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	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	95.9418	106.2213	95.9418	99.1399	95.9418	99.1399	95.9418	95.9418	99.1399	95.9418	99.1399	95.9418	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	190.1965	192.1702	187.1966	176.6086	163.2431	150.6814	142.2895	140.3158	145.2893	155.8774	169.2429	181.8045	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	33.8557	(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)													
	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	-86.8459	(71)
Water heating gains (Table 5)													
	104.6635	102.4051	98.0544	88.5184	82.6775	76.5722	72.8221	75.9202	79.5525	86.3269	95.4682	103.4442	(72)
Total internal gains													
	449.3691	459.3638	439.7601	422.8341	400.4296	381.9607	366.6207	367.7451	379.5489	396.7134	422.4182	439.7578	(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	6.8300	11.2829	0.6300	0.7000	0.7700	23.5513	(75)
Southwest	2.5200	36.7938	0.6300	0.7000	0.7700	28.3366	(79)
Northwest	5.5200	11.2829	0.6300	0.7000	0.7700	19.0341	(81)

Solar gains	70.9220	134.9516	222.2187	338.3163	436.4246	458.5530	431.5718	354.5131	261.8133	159.2806	87.5242	59.0276	(83)
Total gains	520.2911	594.3154	661.9788	761.1505	836.8542	840.5137	798.1925	722.2582	641.3623	555.9940	509.9424	498.7854	(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	15.7923	15.8179	15.8430	15.9623	15.9848	16.0905	16.0905	16.1102	16.0496	15.9848	15.9393	15.8921	
alpha	2.0528	2.0545	2.0562	2.0642	2.0657	2.0727	2.0727	2.0740	2.0700	2.0657	2.0626	2.0595	
util living area													
	0.9187	0.8933	0.8530	0.7723	0.6588	0.5238	0.4133	0.4611	0.6467	0.8156	0.8939	0.9247	(86)
MIT	17.6781	18.0410	18.6343	19.4436	20.1472	20.6322	20.8405	20.7943	20.3938	19.4886	18.4583	17.6120	(87)
Th 2	20.3496	20.3507	20.3517	20.3565	20.3574	20.3617	20.3617	20.3624	20.3600	20.3574	20.3556	20.3537	(88)
util rest of house													
	0.9133	0.8863	0.8431	0.7565	0.6341	0.4868	0.3641	0.4114	0.6127	0.7992	0.8858	0.9196	(89)
MIT 2	17.2108	17.5696	18.1553	18.9486	19.6231	20.0747	20.2549	20.2204	19.8671	19.0041	17.9897	17.1479	(90)
Living area fraction										fLA = Living area / (4) =		0.7145	(91)
MIT	17.5447	17.9064	18.4975	19.3023	19.9976	20.4731	20.6733	20.6304	20.2435	19.3503	18.3245	17.4795	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5447	17.9064	18.4975	19.3023	19.9976	20.4731	20.6733	20.6304	20.2435	19.3503	18.3245	17.4795	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8827	0.8530	0.8088	0.7271	0.6193	0.4935	0.3886	0.4329	0.6061	0.7692	0.8535	0.8901	(94)
Useful gains	459.2679	506.9592	535.3834	553.4212	518.2401	414.8147	310.2103	312.6601	388.7219	427.6672	435.2370	443.9777	(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													
	1154.3265	1131.7250	1042.2816	896.9421	714.4532	502.3731	348.4260	361.4200	526.8411	753.4322	969.2303	1150.0902	(97)
Space heating kWh													
	517.1236	419.8426	377.1323	247.3351	145.9825	0.0000	0.0000	0.0000	0.0000	242.3692	384.4752	525.3477	(98a)
Space heating requirement - total per year (kWh/year)												2859.6082	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	517.1236	419.8426	377.1323	247.3351	145.9825	0.0000	0.0000	0.0000	0.0000	242.3692	384.4752	525.3477	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2859.6082	
Space heating per m2											(98c) / (4) =	42.6807	(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													
	517.1236	419.8426	377.1323	247.3351	145.9825	0.0000	0.0000	0.0000	0.0000	242.3692	384.4752	525.3477	(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)													
	559.6576	454.3751	408.1518	267.6786	157.9898	0.0000	0.0000	0.0000	0.0000	262.3043	416.0987	568.5581	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1242	193.8758	206.3837	182.6624	177.8359	161.0978	159.7036	165.6286	166.9643	185.1359	195.5446	216.9092	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.1539	85.9907	85.6554	85.0315	83.9617	80.3000	80.3000	80.3000	80.3000	84.9596	85.8020	86.2021	(217)
Fuel for water heating, kWh/month													
	254.3405	225.4613	240.9465	214.8175	211.8061	200.6199	198.8837	206.2623	207.9257	217.9106	227.9022	251.6286	(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	19.9348	15.9925	14.3994	10.5496	8.1488	6.6577	7.4336	9.6625	12.5507	16.4672	18.5996	20.4889	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.8283	-33.2427	-49.3438	-57.3614	-63.4938	-59.8726	-59.1466	-55.0296	-48.0373	-38.8533	-25.4732	-19.6152	(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	-9.8721	-21.0507	-42.3656	-64.4006	-85.9016	-86.5745	-85.5486	-72.0868	-52.3865	-30.3505	-13.2607	-7.7851	(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												3094.8140	(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	2658.5049 (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)	160.8854 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1103.8810 (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	4896.3234 (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	3094.8140	0.2100	649.9109	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2658.5049	0.2100	558.2860	(264)
Space and water heating			1208.1970	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	160.8854	0.1443	23.2207	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-532.2977	0.1339	-71.2749	
PV Unit electricity exported	-571.5833	0.1255	-71.7602	
Total			-143.0351	(269)
Total CO2, kg/year			1100.3119	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.4200	(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	3094.8140	1.1300	3497.1398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2658.5049	1.1300	3004.1106	(278)
Space and water heating			6501.2504	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	160.8854	1.5338	246.7714	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-532.2977	1.4948	-795.6971	
PV Unit electricity exported	-571.5833	0.4608	-263.3999	
Total			-1059.0970	(283)
Total Primary energy kWh/year			5819.0256	(286)
Target Primary Energy Rate (TPER)			86.8500	(287)

Full SAP Calculation Printout

Property Reference	Flat 301 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 301 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

---

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)

---

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)

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	

---
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)

---
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	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)												
	-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	32.0822	32.1734	32.2651	32.7318	32.8268	33.3099	33.3099	33.4083	33.1150	32.8268	32.6374	32.4502	
alpha	3.1388	3.1449	3.1510	3.1821	3.1885	3.2207	3.2207	3.2272	3.2077	3.1885	3.1758	3.1633	
util living area	0.8914	0.8312	0.7514	0.6243	0.4838	0.3462	0.2521	0.2810	0.4437	0.6783	0.8382	0.9036	(86)
MIT	19.6223	19.9762	20.3398	20.6930	20.8876	20.9717	20.9924	20.9891	20.9364	20.6645	20.1098	19.5587	(87)
Th 2	20.2081	20.2102	20.2123	20.2227	20.2248	20.2352	20.2352	20.2373	20.2310	20.2248	20.2206	20.2164	(88)
util rest of house	0.8798	0.8151	0.7296	0.5955	0.4491	0.3069	0.2091	0.2356	0.3995	0.6452	0.8199	0.8931	(89)
MIT 2	18.6077	19.0416	19.4813	19.9014	20.1179	20.2127	20.2305	20.2303	20.1774	19.8815	19.2216	18.5352	(90)
Living area fraction									fLA = Living area / (4) =			0.3654	(91)
MIT	18.9784	19.3831	19.7950	20.1907	20.3992	20.4900	20.5089	20.5076	20.4547	20.1676	19.5462	18.9092	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8284	19.2331	19.6450	20.0407	20.2492	20.3400	20.3589	20.3576	20.3047	20.0176	19.3962	18.7592	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8558	0.7926	0.7125	0.5885	0.4502	0.3124	0.2161	0.2428	0.4038	0.6358	0.7979	0.8696	(94)
Useful gains	482.4865	537.0157	544.9754	505.0134	412.2889	282.5374	187.1673	196.0211	301.1087	412.5249	452.6499	464.2622	(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	755.4372	743.1660	679.6266	567.7865	434.4496	287.4649	188.2486	197.6153	312.5667	478.5798	628.4889	748.4509	(97)
Space heating kWh	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(98a)
Space heating requirement - total per year (kWh/year)												890.6582	
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	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												890.6582	
Space heating per m2										(98c) / (4) =		14.6010	(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	203.0753	138.5330	100.1805	45.1966	16.4876	0.0000	0.0000	0.0000	0.0000	49.1449	126.6040	211.4364	(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)	226.8998	154.7855	111.9335	50.4990	18.4218	0.0000	0.0000	0.0000	0.0000	54.9105	141.4570	236.2417	(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	21.1295	19.0847	21.1295	20.4479	21.1295	20.4479	21.1295	21.1295	20.4479	21.1295	20.4479	21.1295 (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	995.1489 (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)	162.7833 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	248.7833 (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	4121.7869 (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	995.1489	0.2100	208.9813	(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			784.3871	(265)
Pumps, fans and electric keep-hot	248.7833	0.1387	34.5093	(267)
Energy for lighting	137.8268	0.1443	19.8927	(268)
Total CO2, kg/year			838.7891	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.7500	(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	995.1489	1.1300	1124.5182	(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			4220.7498	(279)
Pumps, fans and electric keep-hot	248.7833	1.5128	376.3594	(281)
Energy for lighting	137.8268	1.5338	211.4034	(282)
Total Primary energy kWh/year			4808.5126	(286)
Dwelling Primary energy Rate (DPER)			78.8300	(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	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)

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) =	0.1301 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3801 (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) =	0.2946 (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	0.3756	0.3682	0.3609	0.3240	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3461	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(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)
External Wall 1	80.2100	15.2500	64.9600	0.1800	11.6928			(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) =		28.8646			(33)
Party Wall 1			8.9700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 108.4500 (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	0.0200	0.1348
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)		7.9911 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	36.8557 (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	28.9419	28.8029	28.6667	28.0271	27.9074	27.3502	27.3502	27.2471	27.5648	27.9074	28.1495	28.4026	(38)
Heat transfer coeff	65.7975	65.6586	65.5224	64.8827	64.7630	64.2059	64.2059	64.1027	64.4205	64.7630	65.0052	65.2583	(39)
Average = Sum(39)m / 12 =												64.8821	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0786	1.0764	1.0741	1.0637	1.0617	1.0526	1.0526	1.0509	1.0561	1.0617	1.0657	1.0698	(40)
HLP (average)												1.0636	

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

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (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)

---

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)

---

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)

---

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	27.9285	27.9876	28.0458	28.3223	28.3746	28.6208	28.6208	28.6669	28.5255	28.3746	28.2689	28.1593	
alpha	2.8619	2.8658	2.8697	2.8882	2.8916	2.9081	2.9081	2.9111	2.9017	2.8916	2.8846	2.8773	
util living area													
	0.9295	0.8928	0.8409	0.7463	0.6192	0.4701	0.3518	0.3877	0.5737	0.7843	0.8960	0.9373	(86)
MIT	19.0481	19.3975	19.8283	20.3297	20.6942	20.9004	20.9681	20.9571	20.8170	20.3350	19.6158	18.9835	(87)
Th 2	20.0183	20.0202	20.0220	20.0306	20.0322	20.0398	20.0398	20.0412	20.0369	20.0322	20.0290	20.0256	(88)
util rest of house													
	0.9198	0.8788	0.8203	0.7147	0.5736	0.4093	0.2795	0.3130	0.5120	0.7497	0.8800	0.9285	(89)
MIT 2	17.7617	18.1959	18.7263	19.3315	19.7457	19.9643	20.0224	20.0164	19.8873	19.3550	18.4818	17.6858	(90)
Living area fraction										fLA = Living area / (4) =		0.3654	(91)
MIT	18.2318	18.6350	19.1290	19.6962	20.0923	20.3064	20.3679	20.3601	20.2270	19.7131	18.8962	18.1600	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2318	18.6350	19.1290	19.6962	20.0923	20.3064	20.3679	20.3601	20.2270	19.7131	18.8962	18.1600	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8971	0.8548	0.7987	0.7028	0.5766	0.4266	0.3047	0.3384	0.5248	0.7369	0.8572	0.9068	(94)
Useful gains	482.2636	541.5145	561.3401	546.5421	473.9140	345.4482	236.2366	245.9994	355.6183	442.1285	459.7574	463.6409	(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													
	916.6769	901.8178	827.4816	700.4885	543.5087	366.3830	241.9232	253.8538	394.7074	590.1926	766.8124	911.0059	(97)
Space heating kWh													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(98a)
Space heating requirement - total per year (kWh/year)												1590.0352	
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													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1590.0352	
Space heating per m2											(98c) / (4) =	26.0662	(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													
	323.2035	242.1238	198.0092	110.8414	51.7785	0.0000	0.0000	0.0000	0.0000	110.1597	221.0796	332.8396	(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)													
	349.7873	262.0388	214.2957	119.9582	56.0373	0.0000	0.0000	0.0000	0.0000	119.2204	239.2636	360.2160	(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	85.2859	84.9329	84.3660	83.4103	82.1371	80.3000	80.3000	80.3000	80.3000	83.3710	84.7181	85.3682	(217)
Fuel for water heating, kWh/month													
	248.1244	220.4967	236.4033	211.8545	209.6141	194.4045	191.8535	199.8860	201.3836	214.8763	223.1106	245.4063	(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	-13.5810	-20.4023	-31.2295	-37.4723	-42.5137	-40.4688	-39.9849	-36.6967	-31.2778	-24.3483	-15.3725	-11.6004	(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	-4.2822	-9.2564	-18.8685	-29.0425	-39.0963	-39.5307	-39.0576	-32.7430	-23.5805	-13.4555	-5.7866	-3.3675	(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												1720.8174	(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	2597.4138 (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	-603.0156 (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	3949.7441 (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	1720.8174	0.2100	361.3716	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2597.4138	0.2100	545.4569	(264)
Space and water heating			906.8285	(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	-344.9483	0.1333	-45.9705	
PV Unit electricity exported	-258.0673	0.1252	-32.3076	
Total			-78.2782	(269)
Total CO2, kg/year			861.9169	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.1300	(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	1720.8174	1.1300	1944.5236	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2597.4138	1.1300	2935.0776	(278)
Space and water heating			4879.6012	(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	-344.9483	1.4925	-514.8215	
PV Unit electricity exported	-258.0673	0.4595	-118.5826	
Total			-633.4041	(283)
Total Primary energy kWh/year			4604.1159	(286)
Target Primary Energy Rate (TPER)			75.4800	(287)

Full SAP Calculation Printout

Property Reference	Flat 302 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 302 VL - Be Lean	Prop Type Ref	Flat 203 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	82 B	DER	16.79	TER	18.81
Environmental	88 B	% DER < TER			10.74
CO_2 Emissions (t/year)	0.78	DFEE	43.81	TFEE	49.06
Compliance Check	See BREL	% DFEE < TFEE			10.69
% DPER < TPER	4.56	DPER	96.24	TPER	100.84

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

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		51.6300 (1b)	x	2.8300 (2b)	=	146.1129 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.1129	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000	(23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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)

External Wall 1	51.3900	15.1500	36.2400	0.1500	5.4360	14.0000	507.3600 (29a)
External Roof 1	51.6300		51.6300	0.1000	5.1630	9.0000	464.6700 (30)
Total net area of external elements Aum(A, m2)			103.0200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2468		(33)
Party Wall 1			34.8700	0.0000	0.0000	20.0000	697.4000 (32)
Party Floor 1			51.6300			40.0000	2065.2000 (32d)
Internal Wall 1			53.3700			9.0000	480.3300 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4214.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 81.6378 (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
E16 Corner (normal)	2.4000	0.0900	0.2160
E17 Corner (inverted – internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	12.3200	0.1200	1.4784
E15 Flat roof with parapet	18.1600	0.3000	5.4480

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.0748 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.3216 (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	10.8594	10.7193	10.5792	9.8785	9.7384	9.0377	9.0377	8.8976	9.3180	9.7384	10.0186	10.2989	(38)
Heat transfer coeff	48.1810	48.0409	47.9008	47.2001	47.0600	46.3593	46.3593	46.2192	46.6396	47.0600	47.3403	47.6205	(39)

Average = Sum(39)m / 12 = 47.1651

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9332	0.9305	0.9278	0.9142	0.9115	0.8979	0.8979	0.8952	0.9033	0.9115	0.9169	0.9223	(40)
HLP (average)												0.9135	
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 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)

---
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)

---

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)

---

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	24.3005	24.3714	24.4427	24.8055	24.8794	25.2554	25.2554	25.3319	25.1036	24.8794	24.7321	24.5865	
alpha	2.6200	2.6248	2.6295	2.6537	2.6586	2.6837	2.6837	2.6888	2.6736	2.6586	2.6488	2.6391	
util living area													
	0.9089	0.8820	0.8356	0.7354	0.5990	0.4472	0.3382	0.3833	0.5824	0.7832	0.8777	0.9152	(86)
MIT	18.8973	19.1773	19.6181	20.2101	20.6428	20.8836	20.9595	20.9430	20.7569	20.1971	19.4786	18.8599	(87)
Th 2	20.1394	20.1417	20.1440	20.1554	20.1577	20.1693	20.1693	20.1716	20.1647	20.1577	20.1531	20.1486	(88)
util rest of house													
	0.8993	0.8697	0.8184	0.7089	0.5611	0.3976	0.2787	0.3206	0.5309	0.7548	0.8631	0.9062	(89)
MIT 2	17.6747	18.0253	18.5740	19.2997	19.8032	20.0717	20.1431	20.1328	19.9466	19.3025	18.4161	17.6337	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	18.4483	18.7542	19.2347	19.8758	20.3344	20.5854	20.6597	20.6455	20.4593	19.8686	19.0885	18.4096	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2983	18.6042	19.0847	19.7258	20.1844	20.4354	20.5097	20.4955	20.3093	19.7186	18.9385	18.2596	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8735	0.8434	0.7940	0.6943	0.5624	0.4139	0.3035	0.3456	0.5402	0.7383	0.8380	0.8811	(94)
Useful gains	356.5974	380.6541	389.8771	386.7144	342.3373	252.6816	175.6536	181.2966	252.6192	306.7558	330.8608	347.3324	(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													
	674.4536	658.3638	602.8155	510.9787	399.2778	270.5265	181.2516	189.2901	289.6005	429.1203	560.4355	669.5261	(97)
Space heating kWh													
	236.4850	186.6209	158.4261	89.4703	42.3638	0.0000	0.0000	0.0000	0.0000	91.0392	165.2938	239.7121	(98a)
Space heating requirement - total per year (kWh/year)												1209.4112	
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													
	236.4850	186.6209	158.4261	89.4703	42.3638	0.0000	0.0000	0.0000	0.0000	91.0392	165.2938	239.7121	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1209.4112	
Space heating per m2										(98c) / (4) =		23.4246	(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													
	236.4850	186.6209	158.4261	89.4703	42.3638	0.0000	0.0000	0.0000	0.0000	91.0392	165.2938	239.7121	(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)													
	264.2291	208.5149	177.0124	99.9669	47.3338	0.0000	0.0000	0.0000	0.0000	101.7197	184.6858	267.8348	(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	22.3227	20.1624	22.3227	21.6026	22.3227	21.6026	22.3227	22.3227	21.6026	22.3227	21.6026	22.3227 (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	1351.2974 (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)	176.8317 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	262.8317 (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	4259.6435 (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	1351.2974	0.2100	283.7725	(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			810.8020	(265)
Pumps, fans and electric keep-hot	262.8317	0.1387	36.4580	(267)
Energy for lighting	135.8500	0.1443	19.6074	(268)
Total CO2, kg/year			866.8673	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.7900	(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	1351.2974	1.1300	1526.9661	(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			4362.8868	(279)
Pumps, fans and electric keep-hot	262.8317	1.5128	397.6118	(281)
Energy for lighting	135.8500	1.5338	208.3713	(282)
Total Primary energy kWh/year			4968.8699	(286)
Dwelling Primary energy Rate (DPER)			96.2400	(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	2.8300 (2b)	=	146.1129 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.1129 (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) =	0.1369 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3869 (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) =	0.2998 (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	0.3823	0.3748	0.3673	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5675	0.5544	0.5519	0.5406	0.5406	0.5385	0.5449	0.5519	0.5569	0.5621	(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)
External Wall 1	51.3900	12.9200	38.4700	0.1800	6.9246			(29a)
External Roof 1	51.6300		51.6300	0.1100	5.6793			(30)
Total net area of external elements Aum(A, m2)			103.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.1237			(33)
Party Wall 1			34.8700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 81.6378 (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
E16 Corner (normal)	2.4000	0.0900	0.2160
E17 Corner (inverted – internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.3200	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	12.3200	0.1200	1.4784
E15 Flat roof with parapet	18.1600	0.5600	10.1696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.1780 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.3017 (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	27.6319	27.4951	27.3610	26.7311	26.6133	26.0647	26.0647	25.9631	26.2760	26.6133	26.8517	27.1009	(38)
Heat transfer coeff	69.9336	69.7968	69.6627	69.0328	68.9149	68.3663	68.3663	68.2647	68.5777	68.9149	69.1534	69.4026	(39)

Average = Sum(39)m / 12 = 69.0322

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3545	1.3519	1.3493	1.3371	1.3348	1.3242	1.3242	1.3222	1.3283	1.3348	1.3394	1.3442	(40)
HLP (average)												1.3371	
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)
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)

---

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	16.7419	16.7747	16.8070	16.9604	16.9894	17.1257	17.1257	17.1512	17.0729	16.9894	16.9308	16.8700	
alpha	2.1161	2.1183	2.1205	2.1307	2.1326	2.1417	2.1417	2.1434	2.1382	2.1326	2.1287	2.1247	
util living area													
	0.9257	0.9053	0.8699	0.7933	0.6809	0.5437	0.4311	0.4820	0.6727	0.8340	0.9035	0.9306	(86)
MIT	17.7665	18.0864	18.6499	19.4496	20.1522	20.6379	20.8438	20.7964	20.3908	19.5008	18.5192	17.7142	(87)
Th 2	19.7984	19.8004	19.8024	19.8119	19.8137	19.8220	19.8220	19.8235	19.8188	19.8137	19.8101	19.8063	(88)
util rest of house													
	0.9157	0.8927	0.8519	0.7638	0.6334	0.4713	0.3337	0.3831	0.6065	0.8035	0.8886	0.9213	(89)
MIT 2	16.0880	16.4883	17.1915	18.1737	19.0018	19.5388	19.7341	19.7010	19.2993	18.2616	17.0430	16.0253	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	17.1501	17.4995	18.1143	18.9811	19.7298	20.2343	20.4363	20.3941	19.9900	19.0457	17.9771	17.0940	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1501	17.4995	18.1143	18.9811	19.7298	20.2343	20.4363	20.3941	19.9900	19.0457	17.9771	17.0940	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8859	0.8609	0.8201	0.7397	0.6298	0.4980	0.3864	0.4334	0.6170	0.7795	0.8584	0.8923	(94)
Useful gains	365.2226	395.5431	414.5988	429.5785	403.4440	320.9907	235.9281	238.3116	299.4410	331.5974	343.2249	354.7435	(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													
	898.6539	879.4052	809.0854	695.9243	553.3703	385.1940	262.2708	272.6558	403.9191	582.0376	752.1868	894.8772	(97)
Space heating kWh													
	396.8729	325.1553	293.4980	191.7690	111.5452	0.0000	0.0000	0.0000	0.0000	186.3275	294.4525	401.8595	(98a)
Space heating requirement - total per year (kWh/year)												2201.4799	
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													
	396.8729	325.1553	293.4980	191.7690	111.5452	0.0000	0.0000	0.0000	0.0000	186.3275	294.4525	401.8595	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2201.4799	
Space heating per m2											(98c) / (4) =	42.6395	(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													
	396.8729	325.1553	293.4980	191.7690	111.5452	0.0000	0.0000	0.0000	0.0000	186.3275	294.4525	401.8595	(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)													
	429.5161	351.8997	317.6386	207.5422	120.7199	0.0000	0.0000	0.0000	0.0000	201.6532	318.6715	434.9128	(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	85.8303	85.6756	85.3344	84.6864	83.6160	80.3000	80.3000	80.3000	80.3000	84.5903	85.4517	85.8743	(217)
Fuel for water heating, kWh/month													
	231.8268	205.6172	220.0340	196.4834	192.0117	179.1241	176.7630	185.0456	188.2220	199.8588	208.3354	229.4377	(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	-11.5468	-17.3749	-26.6414	-32.0288	-36.4000	-34.6805	-34.2745	-31.4305	-26.7459	-20.7690	-13.0825	-9.8603	(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	-3.5725	-7.7280	-15.7612	-24.2689	-32.6742	-33.0305	-32.6265	-27.3429	-19.6858	-11.2279	-4.8265	-2.8084	(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												2382.5540	(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		2412.7597 (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		-510.3884 (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		4499.2477 (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	2382.5540	0.2100	500.3364	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2412.7597	0.2100	506.6795	(264)
Space and water heating			1007.0159	(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	-294.8350	0.1332	-39.2798	
PV Unit electricity exported	-215.5534	0.1252	-26.9845	
Total			-66.2642	(269)
Total CO2, kg/year			971.2018	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.8100	(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	2382.5540	1.1300	2692.2861	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2412.7597	1.1300	2726.4184	(278)
Space and water heating			5418.7045	(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	-294.8350	1.4923	-439.9835	
PV Unit electricity exported	-215.5534	0.4595	-99.0444	
Total			-539.0278	(283)
Total Primary energy kWh/year			5206.6027	(286)
Target Primary Energy Rate (TPER)			100.8400	(287)

Full SAP Calculation Printout

Property Reference	Flat 302 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 302 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	83 B	DER	15.48	TER	15.99
Environmental	89 B	% DER < TER			3.19
CO_2 Emissions (t/year)	0.73	DFEE	37.03	TFEE	36.62
Compliance Check	See BREL	% DFEE < TFEE			-1.11
% DPER < TPER	-3.20	DPER	88.42	TPER	85.68

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

---

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)

---

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

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)

External Wall 1	66.7800	18.5200	48.2600	0.1500	7.2390	14.0000	675.6400 (29a)
External Roof 1	4.0100		4.0100	0.1000	0.4010	9.0000	36.0900 (30)
Total net area of external elements Aum(A, m2)			70.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3595		(33)
Party Wall 1			18.4000	0.0000	0.0000	20.0000	368.0000 (32)
Party Floor 1			52.0000			40.0000	2080.0000 (32d)
Party Ceiling 1			47.9900			30.0000	1439.7000 (32b)
Internal Wall 1			45.1100			9.0000	405.9900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5005.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 96.2581 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
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	7.5600	0.0600	0.4536
E16 Corner (normal)	2.5200	0.0900	0.2268
E17 Corner (inverted – internal area greater than external area)	5.0400	-0.0900	-0.4536
E7 Party floor between dwellings (in blocks of flats)	53.0000	0.0700	3.7100
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)	14.6000	0.0000	0.0000
E15 Flat roof with parapet	6.5300	0.5600	3.6568
E24 Eaves (insulation at ceiling level - inverted)	6.5300	0.2400	1.5672

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6316 (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	9.7392	9.6135	9.4878	8.8595	8.7338	8.1054	8.1054	7.9797	8.3567	8.7338	8.9851	9.2365	(38)
Heat transfer coeff	48.3708	48.2451	48.1194	47.4910	47.3654	46.7370	46.7370	46.6113	46.9883	47.3654	47.6167	47.8681	(39)

Average = Sum(39)m / 12 = 47.4596

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9302	0.9278	0.9254	0.9133	0.9109	0.8988	0.8988	0.8964	0.9036	0.9109	0.9157	0.9205	(40)
HLP (average)												0.9127	
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

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)

---
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 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	28.7445	28.8194	28.8947	29.2770	29.3547	29.7493	29.7493	29.8296	29.5902	29.3547	29.1997	29.0464	
alpha	2.9163	2.9213	2.9263	2.9518	2.9570	2.9833	2.9833	2.9886	2.9727	2.9570	2.9466	2.9364	
util living area	0.8815	0.8210	0.7480	0.6379	0.5117	0.3764	0.2750	0.2994	0.4542	0.6732	0.8277	0.8942	(86)
MIT	19.4670	19.8409	20.2170	20.5933	20.8289	20.9500	20.9854	20.9808	20.9095	20.5959	19.9926	19.3969	(87)
Th 2	20.1419	20.1439	20.1460	20.1562	20.1583	20.1685	20.1685	20.1706	20.1644	20.1583	20.1542	20.1501	(88)
util rest of house	0.8688	0.8037	0.7251	0.6077	0.4738	0.3312	0.2246	0.2475	0.4062	0.6383	0.8080	0.8826	(89)
MIT 2	18.3697	18.8272	19.2823	19.7313	19.9958	20.1290	20.1598	20.1586	20.0888	19.7474	19.0300	18.2892	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	19.0816	19.4850	19.8888	20.2906	20.5364	20.6617	20.6955	20.6921	20.6213	20.2979	19.6546	19.0079	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9316	19.3350	19.7388	20.1406	20.3864	20.5117	20.5455	20.5421	20.4713	20.1479	19.5046	18.8579	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8478	0.7855	0.7134	0.6071	0.4843	0.3501	0.2476	0.2709	0.4242	0.6378	0.7911	0.8617	(94)
Useful gains	438.0028	488.4836	494.0878	458.5190	379.9714	267.6784	182.1630	190.0930	283.5489	379.4105	412.5354	421.2312	(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	707.7438	696.4157	637.0435	533.8290	411.4323	276.2969	184.3987	193.0697	299.3760	452.2417	590.6642	701.6476	(97)
Space heating kWh	200.6873	139.7304	106.3590	54.2232	23.4069	0.0000	0.0000	0.0000	0.0000	54.1864	128.2528	208.6297	(98a)
Space heating requirement - total per year (kWh/year)												915.4757	
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	200.6873	139.7304	106.3590	54.2232	23.4069	0.0000	0.0000	0.0000	0.0000	54.1864	128.2528	208.6297	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												915.4757	
Space heating per m2											(98c) / (4) =	17.6053	(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	200.6873	139.7304	106.3590	54.2232	23.4069	0.0000	0.0000	0.0000	0.0000	54.1864	128.2528	208.6297	(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)	224.2316	156.1234	118.8369	60.5846	26.1530	0.0000	0.0000	0.0000	0.0000	60.5435	143.2992	233.1059	(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 19.0897	17.2423	19.0897	18.4739	19.0897	18.4739	19.0897	19.0897	18.4739	19.0897	18.4739	19.0897 (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	1022.8779 (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)	138.7661 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	224.7661 (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	3947.7303 (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	1022.8779	0.2100	214.8044	(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			755.3846	(265)
Pumps, fans and electric keep-hot	224.7661	0.1387	31.1778	(267)
Energy for lighting	125.8946	0.1443	18.1705	(268)
Total CO2, kg/year			804.7329	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.4800	(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	1022.8779	1.1300	1155.8520	(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			4064.6886	(279)
Pumps, fans and electric keep-hot	224.7661	1.5128	340.0262	(281)
Energy for lighting	125.8946	1.5338	193.1013	(282)
Total Primary energy kWh/year			4597.8161	(286)
Dwelling Primary energy Rate (DPER)			88.4200	(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	2.5200 (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)

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)
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)

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)
External Wall 1	66.7800	13.0100	53.7700	0.1800	9.6786			(29a)
External Roof 1	4.0100		4.0100	0.1100	0.4411			(30)
Total net area of external elements Aum(A, m2)			70.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.7266			(33)
Party Wall 1			18.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 105.4869 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
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	7.5600	0.0600	0.4536
E16	Corner (normal)	2.5200	0.0900	0.2268
E17	Corner (inverted – internal area greater than external area)	5.0400	-0.0900	-0.4536
E7	Party floor between dwellings (in blocks of flats)	53.0000	0.0700	3.7100
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)	14.6000	0.0000	0.0000
E15	Flat roof with parapet	6.5300	0.5600	3.6568
E24	Eaves (insulation at ceiling level - inverted)	6.5300	0.2400	1.5672

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4211 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.1477 (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	61.1915	61.0586	60.9284	60.3166	60.2021	59.6692	59.6692	59.5705	59.8745	60.2021	60.4337	60.6758	(39)

Average = Sum(39)m / 12 = 60.3160

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1768	1.1742	1.1717	1.1599	1.1577	1.1475	1.1475	1.1456	1.1514	1.1577	1.1622	1.1668	(40)
HLP (average)												1.1599	
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	77.0499	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)

---

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)

---

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	24.9005	24.9547	25.0080	25.2617	25.3098	25.5358	25.5358	25.5781	25.4482	25.3098	25.2128	25.1122	
alpha	2.6600	2.6636	2.6672	2.6841	2.6873	2.7024	2.7024	2.7052	2.6965	2.6873	2.6809	2.6741	
util living area													
	0.9177	0.8768	0.8246	0.7380	0.6239	0.4832	0.3635	0.3928	0.5645	0.7647	0.8808	0.9265	(86)
MIT	18.8814	19.2624	19.7105	20.2240	20.6162	20.8626	20.9531	20.9408	20.7807	20.2669	19.4961	18.8108	(87)
Th 2	19.9386	19.9407	19.9427	19.9522	19.9540	19.9622	19.9622	19.9638	19.9591	19.9540	19.9504	19.9466	(88)
util rest of house													
	0.9064	0.8609	0.8021	0.7047	0.5760	0.4176	0.2840	0.3122	0.4997	0.7273	0.8626	0.9162	(89)
MIT 2	17.5063	17.9776	18.5280	19.1483	19.5964	19.8590	19.9372	19.9304	19.7824	19.2162	18.2840	17.4235	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	18.3985	18.8112	19.2953	19.8463	20.2581	20.5102	20.5963	20.5860	20.4301	19.8979	19.0705	18.3236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3985	18.8112	19.2953	19.8463	20.2581	20.5102	20.5963	20.5860	20.4301	19.8979	19.0705	18.3236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8860	0.8408	0.7865	0.7010	0.5905	0.4530	0.3332	0.3614	0.5301	0.7251	0.8445	0.8964	(94)
Useful gains	442.9661	500.1661	516.2811	498.4653	433.9917	324.1464	229.3983	237.8264	333.6579	410.0346	424.0350	425.1694	(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													
	862.7112	849.4010	779.5956	660.2412	515.2131	352.6546	238.4590	249.3634	379.0123	559.7531	723.4199	856.9623	(97)
Space heating kWh													
	312.2903	234.6859	195.9059	116.4787	60.4287	0.0000	0.0000	0.0000	0.0000	111.3906	215.5571	321.2539	(98a)
Space heating requirement - total per year (kWh/year)												1567.9910	
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													
	312.2903	234.6859	195.9059	116.4787	60.4287	0.0000	0.0000	0.0000	0.0000	111.3906	215.5571	321.2539	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1567.9910	
Space heating per m2											(98c) / (4) =	30.1537	(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													
	312.2903	234.6859	195.9059	116.4787	60.4287	0.0000	0.0000	0.0000	0.0000	111.3906	215.5571	321.2539	(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)													
	337.9765	253.9890	212.0194	126.0592	65.3990	0.0000	0.0000	0.0000	0.0000	120.5525	233.2869	347.6774	(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	85.3375	84.9914	84.4672	83.6244	82.4764	80.3000	80.3000	80.3000	80.3000	83.5038	84.7871	85.4169	(217)
Fuel for water heating, kWh/month													
	233.7608	207.7979	222.8486	199.6614	195.3327	179.7386	177.3695	185.6805	188.8679	202.9446	210.4893	231.2532	(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	1696.9600 (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	2435.7451 (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	3833.8644 (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	1696.9600	0.2100	356.3616	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2435.7451	0.2100	511.5065	(264)
Space and water heating			867.8681	(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			831.7070	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.9900	(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	1696.9600	1.1300	1917.5648	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2435.7451	1.1300	2752.3920	(278)
Space and water heating			4669.9567	(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			4455.4713	(286)
Target Primary Energy Rate (TPER)			85.6800	(287)

Full SAP Calculation Printout

Property Reference	Flat 303 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 303 VL - Be Lean	Prop Type Ref	Flat 203 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	84 B	DER	14.24	TER	15.52
Environmental	90 B	% DER < TER			8.25
CO_2 Emissions (t/year)	0.67	DFEE	33.38	TFEE	34.14
Compliance Check	See BREL	% DFEE < TFEE			2.23
% DPER < TPER	0.77	DPER	82.50	TPER	83.14

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.6300	(1b)	x 2.8300	(2b) =	146.1129	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		146.1129	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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)

External Wall 1	51.3900	15.1500	36.2400	0.1500	5.4360	14.0000	507.3600 (29a)
Total net area of external elements Aum(A, m2)			51.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.0838		(33)
Party Wall 1			34.8700	0.0000	0.0000	20.0000	697.4000 (32)
Party Floor 1			51.6300			40.0000	2065.2000 (32d)
Party Ceiling 1			51.6300			30.0000	1548.9000 (32b)
Internal Wall 1			53.3700			9.0000	480.3300 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5299.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 102.6378 (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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.4430	2.7422
E16 Corner (normal)	2.8300	0.0900	0.2547
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	11.3200	0.0600	0.6792
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.5228 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 26.6066 (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	10.8594	10.7193	10.5792	9.8785	9.7384	9.0377	9.0377	8.8976	9.3180	9.7384	10.0186	10.2989	(38)
Heat transfer coeff	37.4660	37.3259	37.1858	36.4851	36.3450	35.6443	35.6443	35.5042	35.9246	36.3450	36.6253	36.9055	(39)
Average = Sum(39)m / 12 =												36.4501	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7257	0.7229	0.7202	0.7067	0.7040	0.6904	0.6904	0.6877	0.6958	0.7040	0.7094	0.7148	(40)
HLP (average)												0.7060	
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	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)

---

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	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)												
	-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)

---

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)

---

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	39.2888	39.4363	39.5850	40.3451	40.5007	41.2968	41.2968	41.4598	40.9746	40.5007	40.1908	39.8856	
alpha	3.6193	3.6291	3.6390	3.6897	3.7000	3.7531	3.7531	3.7640	3.7316	3.7000	3.6794	3.6590	
util living area													
	0.9078	0.8690	0.8050	0.6737	0.5164	0.3625	0.2649	0.3007	0.4882	0.7297	0.8635	0.9157 (86)	
MIT	19.8879	20.1209	20.4176	20.7499	20.9212	20.9843	20.9963	20.9941	20.9530	20.7193	20.2837	19.8595 (87)	
Th 2	20.3182	20.3206	20.3230	20.3349	20.3373	20.3493	20.3493	20.3517	20.3445	20.3373	20.3326	20.3278 (88)	
util rest of house													
	0.8980	0.8560	0.7867	0.6478	0.4845	0.3271	0.2262	0.2591	0.4467	0.7006	0.8480	0.9067 (89)	
MIT 2	19.0162	19.3051	19.6684	20.0693	20.2611	20.3365	20.3470	20.3479	20.3038	20.0445	19.5199	18.9882 (90)	
Living area fraction										fLA = Living area / (4) =		0.6328 (91)	
MIT	19.5678	19.8214	20.1425	20.5000	20.6788	20.7464	20.7579	20.7568	20.7146	20.4715	20.0032	19.5395 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.4178	19.6714	19.9925	20.3500	20.5288	20.5964	20.6079	20.6068	20.5646	20.3215	19.8532	19.3895 (93)	

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8832	0.8423	0.7772	0.6484	0.4938	0.3406	0.2416	0.2756	0.4608	0.6999	0.8358	0.8922 (94)	
Useful gains	370.7191	395.2373	397.1615	372.3487	306.7880	211.1470	142.3257	148.4941	224.3255	303.8251	341.2273	360.6779 (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													
	566.4038	551.3541	501.7283	417.7534	320.8821	213.7375	142.8574	149.3585	232.2378	353.3273	467.0887	560.5768 (97)	
Space heating kWh													
	145.5894	104.9105	77.7977	32.6914	10.4860	0.0000	0.0000	0.0000	0.0000	36.8297	90.6202	148.7248 (98a)	
Space heating requirement - total per year (kWh/year)												647.6497	
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													
	145.5894	104.9105	77.7977	32.6914	10.4860	0.0000	0.0000	0.0000	0.0000	36.8297	90.6202	148.7248 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												647.6497	
Space heating per m2											(98c) / (4) =	12.5441 (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													
	145.5894	104.9105	77.7977	32.6914	10.4860	0.0000	0.0000	0.0000	0.0000	36.8297	90.6202	148.7248 (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)													
	162.6697	117.2184	86.9249	36.5267	11.7162	0.0000	0.0000	0.0000	0.0000	41.1505	101.2516	166.1730 (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	22.3227	20.1624	22.3227	21.6026	22.3227	21.6026	22.3227	22.3227	21.6026	22.3227	21.6026	22.3227 (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	723.6309 (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)	176.8317 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	262.8317 (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	3631.9770 (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	723.6309	0.2100	151.9625	(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			678.9920	(265)
Pumps, fans and electric keep-hot	262.8317	0.1387	36.4580	(267)
Energy for lighting	135.8500	0.1443	19.6074	(268)
Total CO2, kg/year			735.0574	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.2400	(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	723.6309	1.1300	817.7029	(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			3653.6237	(279)
Pumps, fans and electric keep-hot	262.8317	1.5128	397.6118	(281)
Energy for lighting	135.8500	1.5338	208.3713	(282)
Total Primary energy kWh/year			4259.6067	(286)
Dwelling Primary energy Rate (DPER)			82.5000	(287)

CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.6300 (1b)	x	2.8300 (2b)	=	146.1129	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.1129	(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) =	0.1369	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3869	(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) =	0.2998	(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	0.3823	0.3748	0.3673	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5675	0.5544	0.5519	0.5406	0.5406	0.5385	0.5449	0.5519	0.5569	0.5621	(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)
External Wall 1	51.3900	12.9200	38.4700	0.1800	6.9246			(29a)
Total net area of external elements Aum(A, m2)			51.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4444			(33)
Party Wall 1			34.8700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.6378 (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)	36.3200	0.0700	2.5424
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
E16 Corner (normal)	2.8300	0.0900	0.2547
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	11.3200	0.0600	0.6792
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	24.6400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.9044	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	26.3488	(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	27.6319	27.4951	27.3610	26.7311	26.6133	26.0647	26.0647	25.9631	26.2760	26.6133	26.8517	27.1009	(38)
Heat transfer coeff	53.9807	53.8439	53.7098	53.0799	52.9620	52.4134	52.4134	52.3118	52.6248	52.9620	53.2005	53.4497	(39)
Average = Sum(39)m / 12 =												53.0793	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0455	1.0429	1.0403	1.0281	1.0258	1.0152	1.0152	1.0132	1.0193	1.0258	1.0304	1.0352	(40)
HLP (average)												1.0281	
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 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
374.2383 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	29.9258	30.0018	30.0767	30.4336	30.5013	30.8206	30.8206	30.8805	30.6968	30.5013	30.3647	30.2231
alpha	2.9951	3.0001	3.0051	3.0289	3.0334	3.0547	3.0547	3.0587	3.0465	3.0334	3.0243	3.0149

util living area

	0.9415	0.9166	0.8731	0.7767	0.6373	0.4775	0.3593	0.4068	0.6172	0.8249	0.9153	0.9470 (86)
MIT	19.0961	19.3751	19.7905	20.3268	20.7117	20.9129	20.9726	20.9599	20.8070	20.3011	19.6267	19.0529 (87)
Th 2	20.0456	20.0478	20.0499	20.0600	20.0619	20.0707	20.0707	20.0723	20.0673	20.0619	20.0581	20.0541 (88)
util rest of house												
	0.9330	0.9049	0.8554	0.7469	0.5922	0.4173	0.2876	0.3311	0.5557	0.7939	0.9015	0.9393 (89)
MIT 2	17.8362	18.1855	18.7013	19.3531	19.7911	20.0047	20.0558	20.0491	19.9076	19.3411	18.5134	17.7874 (90)
Living area fraction										fLA = Living area / (4) =		0.6328 (91)
MIT	18.6334	18.9382	19.3905	19.9693	20.3736	20.5794	20.6359	20.6254	20.4767	19.9486	19.2179	18.5882 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6334	18.9382	19.3905	19.9693	20.3736	20.5794	20.6359	20.6254	20.4767	19.9486	19.2179	18.5882 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9175	0.8886	0.8413	0.7438	0.6078	0.4508	0.3316	0.3768	0.5837	0.7897	0.8868	0.9243	(94)
Useful gains	390.0611	426.0740	444.1105	446.3309	397.8320	295.2927	206.2964	213.2748	295.7608	352.3496	367.9472	377.8388	(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	773.7296	755.8723	692.3458	587.5559	459.3737	313.4009	211.5376	221.0408	335.5719	495.1191	644.6768	769.0425	(97)
Space heating kWh	285.4493	221.6245	184.6871	101.6820	45.7871	0.0000	0.0000	0.0000	0.0000	106.2205	199.2453	291.0555	(98a)
Space heating requirement - total per year (kWh/year)												1435.7513	
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	285.4493	221.6245	184.6871	101.6820	45.7871	0.0000	0.0000	0.0000	0.0000	106.2205	199.2453	291.0555	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1435.7513	
Space heating per m2											(98c) / (4) =	27.8085	(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	285.4493	221.6245	184.6871	101.6820	45.7871	0.0000	0.0000	0.0000	0.0000	106.2205	199.2453	291.0555	(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)	308.9278	239.8533	199.8778	110.0454	49.5531	0.0000	0.0000	0.0000	0.0000	114.9573	215.6335	314.9952	(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	85.1540	84.8745	84.3460	83.3587	82.0616	80.3000	80.3000	80.3000	80.3000	83.4136	84.6234	85.2159	(217)
Fuel for water heating, kWh/month	233.6680	207.5581	222.6122	199.6129	195.6488	179.1241	176.7630	185.0456	188.2220	202.6783	210.3747	231.2105	(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	-11.5468	-17.3749	-26.6414	-32.0288	-36.4000	-34.6805	-34.2745	-31.4305	-26.7459	-20.7690	-13.0825	-9.8603	(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	-3.5725	-7.7280	-15.7612	-24.2689	-32.6742	-33.0305	-32.6265	-27.3429	-19.6858	-11.2279	-4.8265	-2.8084	(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												1553.8434	(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												2432.5183	(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	-510.3884 (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	3690.2957 (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	1553.8434	0.2100	326.3071	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2432.5183	0.2100	510.8288	(264)
Space and water heating			837.1360	(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	-294.8350	0.1332	-39.2798	
PV Unit electricity exported	-215.5534	0.1252	-26.9845	
Total			-66.2642	(269)
Total CO2, kg/year			801.3219	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5200	(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	1553.8434	1.1300	1755.8431	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2432.5183	1.1300	2748.7456	(278)
Space and water heating			4504.5887	(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	-294.8350	1.4923	-439.9835	
PV Unit electricity exported	-215.5534	0.4595	-99.0444	
Total			-539.0278	(283)
Total Primary energy kWh/year			4292.4869	(286)
Target Primary Energy Rate (TPER)			83.1400	(287)

Full SAP Calculation Printout

Property Reference	Flat 303 WCS - Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 303 WCS - Lean	Prop Type Ref	Flat 102 WCS - Lean
Property	West Central Street, London, WC1A		

SAP Rating	85 B	DER	11.86	TER	12.50
Environmental	90 B	% DER < TER			5.12
CO_2 Emissions (t/year)	0.8	DFEE	29.56	TFEE	29.79
Compliance Check	See BREL	% DFEE < TFEE			0.79
% DPER < TPER	-4.28	DPER	69.36	TPER	66.51

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		74.0000 (1b)	x	2.5200 (2b)	=	186.4800 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.4800 (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)			19.9200	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)

External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9800 (29a)
Total net area of external elements Aum(A, m2)			68.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9691		(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			74.0000			40.0000	2960.0000 (32d)
Party Ceiling 1			74.0000			30.0000	2220.0000 (32b)
Internal Wall 1			88.7000			9.0000	798.3000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7446.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.6254 (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	0.4430	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)	54.4400	0.0700	3.8108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9369 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	39.9060 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.8596	13.6808	13.5019	12.6077	12.4288	11.5346	11.5346	11.3558	11.8923	12.4288	12.7865	13.1442	(38)
Heat transfer coeff	53.7656	53.5868	53.4079	52.5137	52.3348	51.4406	51.4406	51.2618	51.7983	52.3348	52.6925	53.0502	(39)
Average = Sum(39)m / 12 =												52.4690	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7266	0.7241	0.7217	0.7096	0.7072	0.6951	0.6951	0.6927	0.7000	0.7072	0.7121	0.7169	(40)
HLP (average)												0.7090	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3392 (42)
Hot water usage for mixer showers	63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972 (42a)
Hot water usage for baths	28.8470	28.4185	27.8152	26.7029	25.8699	24.9463	24.4474	25.0465	25.6988	26.6871	27.8224	28.7494 (42b)
Hot water usage for other uses	40.6165	39.1395	37.6626	36.1856	34.7087	33.2317	33.2317	34.7087	36.1856	37.6626	39.1395	40.6165 (42c)
Average daily hot water use (litres/day)												122.1596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.9037	130.0450	126.5754	121.3280	117.0565	112.4683	110.7260	114.1808	117.8214	122.6355	127.9629	132.5632	(44)
Energy conte	210.4870	185.1823	194.5417	166.0920	157.5805	138.2929	133.9135	141.3797	145.2856	166.4152	182.3067	207.5619	(45)
Energy content (annual)										Total = Sum(45)m =		2029.0391	
Distribution loss (46)m = 0.15 x (45)m	31.5731	27.7773	29.1813	24.9138	23.6371	20.7439	20.0870	21.2070	21.7928	24.9623	27.3460	31.1343	(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	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(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	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(64)
										Total per year (kWh/year) = Sum(64)m =		2629.0391	(64)
12Total per year (kWh/year)												2629	(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	82.7267	73.0800	77.4249	67.5543	65.1352	58.3112	57.2660	59.7485	60.6362	68.0728	72.9457	81.7540	(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	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.1289	115.2856	104.1289	107.5999	104.1289	107.5999	104.1289	104.1289	107.5999	104.1289	107.5999	104.1289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(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)												
	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678 (71)
Water heating gains (Table 5)												
	111.1918	108.7500	104.0657	93.8255	87.5474	80.9877	76.9704	80.3071	84.2170	91.4957	101.3135	109.8845 (72)
Total internal gains												
	482.8559	493.7130	472.4736	454.2117	429.9551	410.2315	393.6342	394.8286	407.6079	425.9083	453.7046	472.4396 (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	635.3827	760.7173	856.9108	962.5798	1028.6070	1017.4146	973.6716	905.5442	834.6538	726.1576	637.7068	602.1230 (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	38.4709	38.5993	38.7286	39.3880	39.5226	40.2097	40.2097	40.3500	39.9320	39.5226	39.2544	38.9897	
alpha	3.5647	3.5733	3.5819	3.6259	3.6348	3.6806	3.6806	3.6900	3.6621	3.6348	3.6170	3.5993	
util living area													
	0.8926	0.8276	0.7406	0.6018	0.4562	0.3201	0.2316	0.2591	0.4170	0.6602	0.8341	0.9053	(86)
MIT	19.9366	20.2496	20.5496	20.8183	20.9435	20.9885	20.9974	20.9960	20.9697	20.7898	20.3515	19.8827	(87)
Th 2	20.3174	20.3196	20.3217	20.3323	20.3345	20.3451	20.3451	20.3473	20.3409	20.3345	20.3302	20.3259	(88)
util rest of house													
	0.8818	0.8124	0.7201	0.5759	0.4266	0.2883	0.1975	0.2228	0.3799	0.6300	0.8169	0.8956	(89)
MIT 2	19.0760	19.4595	19.8211	20.1414	20.2803	20.3358	20.3435	20.3447	20.3149	20.1183	19.5989	19.0160	(90)
Living area fraction										fLA = Living area / (4) =		0.5274	(91)
MIT	19.5299	19.8762	20.2053	20.4984	20.6301	20.6801	20.6884	20.6882	20.6603	20.4725	19.9958	19.4732	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3799	19.7262	20.0553	20.3484	20.4801	20.5301	20.5384	20.5382	20.5103	20.3225	19.8458	19.3232	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8649	0.7980	0.7117	0.5766	0.4332	0.2973	0.2076	0.2334	0.3895	0.6294	0.8032	0.8788	(94)
Useful gains	549.5166	607.0399	609.8572	555.0035	445.5825	302.5028	202.0945	211.3638	325.1088	457.0657	512.2207	529.1639	(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													
	810.7799	794.4898	723.9629	601.1983	459.5037	305.0477	202.5912	212.1318	332.0408	508.8256	671.6098	802.2867	(97)
Space heating kWh													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(98a)
Space heating requirement - total per year (kWh/year)												805.3315	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												805.3315	
Space heating per m2											(98c) / (4) =	10.8829	(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	483.5417	380.6605	389.5894	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9751	0.9864	0.9817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	471.4874	375.4933	382.4620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1140.4963	1091.7621	1013.3195	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	481.6864	532.9040	469.3580	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	120.4216	133.2260	117.3395	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												370.9871 (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)	4.0300 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	194.3799	125.9663	84.8946	33.2603	10.3573	0.0000	0.0000	0.0000	0.0000	38.5094	114.7602	203.2034	(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)													
	217.1843	140.7445	94.8543	37.1623	11.5724	0.0000	0.0000	0.0000	0.0000	43.0273	128.2237	227.0429	(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													
	261.4459	231.2097	245.5006	215.4070	208.5394	187.6080	184.8724	192.3386	194.6007	217.3741	231.6217	258.5208	(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													
	292.1184	258.3349	274.3024	240.6782	233.0049	209.6179	206.5614	214.9035	217.4309	242.8761	258.7952	288.8500	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	29.8813	33.0586	29.1165	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.0759	21.7460	24.0759	23.2993	24.0759	23.2993	24.0759	24.0759	23.2993	24.0759	23.2993	24.0759	(231)
Lighting	19.1300	15.3468	13.8181	10.1237	7.8198	6.3889	7.1335	9.2724	12.0440	15.8023	17.8487	19.6617	(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	899.8118 (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	2937.4739 (219)
Space cooling fuel	92.0564 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	197.4749 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	283.4749 (231)
Electricity for lighting (calculated in Appendix L)	154.3899 (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	4367.2067 (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	899.8118	0.2100	188.9605	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2937.4739	0.2100	616.8695	(264)
Space and water heating			805.8300	(265)
Space cooling	92.0564	0.1142	10.5163	(266)
Pumps, fans and electric keep-hot	283.4749	0.1387	39.3215	(267)

Energy for lighting	154.3899	0.1443	22.2832 (268)
Total CO2, kg/year			877.9510 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.8600 (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	899.8118	1.1300	1016.7873	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2937.4739	1.1300	3319.3455	(278)
Space and water heating			4336.1328	(279)
Space cooling	92.0564	1.4210	130.8131	(280)
Pumps, fans and electric keep-hot	283.4749	1.5128	428.8408	(281)
Energy for lighting	154.3899	1.5338	236.8084	(282)
Total Primary energy kWh/year			5132.5950	(286)
Dwelling Primary energy Rate (DPER)			69.3600	(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	74.0000 (1b)	x	2.5200 (2b)	=	186.4800	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.4800	(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) =	0.1609	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4109	(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) =	0.3184	(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	0.4060	0.3980	0.3901	0.3503	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3742	(22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5458	0.5458	0.5434	0.5507	0.5586	0.5642	0.5700	(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)			16.5100	1.1450	18.9046			(27)
External Wall 1	68.5900	18.5100	50.0800	0.1800	9.0144			(29a)
Total net area of external elements Aum(A, m2)			68.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9190			(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 110.6254 (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)	54.4400	0.0700	3.8108
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8811 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 37.8001 (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	35.8410	35.6440	35.4510	34.5443	34.3746	33.5849	33.5849	33.4387	33.8891	34.3746	34.7178	35.0766	(38)
Heat transfer coeff	73.6411	73.4441	73.2511	72.3443	72.1747	71.3850	71.3850	71.2387	71.6892	72.1747	72.5179	72.8767	(39)

Average = Sum(39)m / 12 = 72.3435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9951	0.9925	0.9899	0.9776	0.9753	0.9647	0.9647	0.9627	0.9688	0.9753	0.9800	0.9848	(40)
HLP (average)												0.9776	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3392 (42)

Hot water usage for mixer showers

63.4403	62.4869	61.0976	58.4395	56.4779	54.2903	53.0469	54.4256	55.9370	58.2858	61.0010	63.1972	(42a)

Hot water usage for baths

27.4046	26.9976	26.4245	25.3677	24.5764	23.6990	23.2251	23.7942	24.4139	25.3527	26.4313	27.3120	(42b)

Hot water usage for other uses

38.5857	37.1826	35.7795	34.3763	32.9732	31.5701	31.5701	32.9732	34.3763	35.7795	37.1826	38.5857	(42c)

Average daily hot water use (litres/day) 118.9761 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4306	126.6671	123.3016	118.1836	114.0275	109.5594	107.8421	111.1931	114.7272	119.4180	124.6149	129.0949	(44)
Energy conte	204.9864	180.3722	189.5099	161.7874	153.5030	134.7161	130.4256	137.6802	141.4701	162.0491	177.5367	202.1314	(45)

Energy content (annual) Total = Sum(45)m = 1976.1681

Distribution loss (46)m = 0.15 x (45)m	30.7480	27.0558	28.4265	24.2681	23.0254	20.2074	19.5638	20.6520	21.2205	24.3074	26.6305	30.3197	(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

	255.9453	226.3996	240.4688	211.1025	204.4619	184.0312	181.3845	188.6391	190.7852	213.0080	226.8518	253.0903	(62)
WWHRS	-29.0022	-25.6498	-26.8590	-22.2403	-20.7272	-17.7364	-16.6250	-17.6791	-18.3508	-21.6335	-24.5082	-28.4652	(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	226.9430	200.7498	213.6098	188.8621	183.7347	166.2948	164.7595	170.9601	172.4344	191.3745	202.3436	224.6251	(64)

Total per year (kWh/year) = Sum(64)m = 2306.6914 (64)

12Total per year (kWh/year) 2307 (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

	80.8977	71.4806	75.7518	66.1231	63.7795	57.1219	56.1062	58.5184	59.3676	66.6211	71.3597	79.9484	(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	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	104.1276	115.2841	104.1276	107.5985	104.1276	107.5985	104.1276	104.1276	107.5985	104.1276	107.5985	104.1276	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4473	208.5895	203.1911	191.6984	177.1909	163.5559	154.4469	152.3047	157.7031	169.1958	183.7033	197.3383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	34.6960	(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)	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	-93.5678	(71)
Water heating gains (Table 5)	108.7335	106.3700	101.8169	91.8376	85.7251	79.3359	75.4116	78.6538	82.4550	89.5444	99.1107	107.4575	(72)

Total internal gains

	480.3962	491.3315	470.2234	452.2224	428.1315	408.5782	392.0740	393.1739	405.8445	423.9557	451.5004	470.0113 (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	1.1700	11.2829	0.6300	0.7000	0.7700	4.0344 (75)
Southeast	9.3100	36.7938	0.6300	0.7000	0.7700	104.6879 (77)
Southwest	1.4100	36.7938	0.6300	0.7000	0.7700	15.8550 (79)
Northwest	4.6200	11.2829	0.6300	0.7000	0.7700	15.9307 (81)

Solar gains	140.5081	245.9688	354.1600	468.3465	551.5362	559.4018	534.3899	470.5144	393.4183	276.5973	169.5039	119.4642 (83)
Total gains	620.9043	737.3003	824.3835	920.5689	979.6676	967.9800	926.4639	863.6883	799.2628	700.5530	621.0043	589.4754 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.8791	30.9619	31.0435	31.4325	31.5064	31.8550	31.8550	31.9204	31.7198	31.5064	31.3573	31.2029	
alpha	3.0586	3.0641	3.0696	3.0955	3.1004	3.1237	3.1237	3.1280	3.1147	3.1004	3.0905	3.0802	
util living area	0.9347	0.8962	0.8402	0.7365	0.6004	0.4470	0.3313	0.3678	0.5574	0.7816	0.9003	0.9425	(86)
MIT	19.2285	19.5758	19.9903	20.4583	20.7719	20.9333	20.9803	20.9724	20.8648	20.4422	19.7692	19.1694	(87)
Th 2	20.0874	20.0896	20.0918	20.1020	20.1039	20.1129	20.1129	20.1145	20.1094	20.1039	20.1001	20.0960	(88)
util rest of house	0.9258	0.8829	0.8202	0.7057	0.5571	0.3917	0.2673	0.3011	0.4997	0.7481	0.8853	0.9345	(89)
MIT 2	18.0300	18.4619	18.9717	19.5360	19.8898	20.0620	20.1019	20.0984	19.9984	19.5335	18.7174	17.9619	(90)
Living area fraction										fLA = Living area / (4) =		0.5274	(91)
MIT	18.6621	19.0494	19.5089	20.0225	20.3550	20.5215	20.5652	20.5594	20.4554	20.0128	19.2721	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6621	19.0494	19.5089	20.0225	20.3550	20.5215	20.5652	20.5594	20.4554	20.0128	19.2721	18.5988	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9085	0.8651	0.8059	0.7028	0.5696	0.4176	0.3003	0.3350	0.5228	0.7444	0.8689	0.9180	(94)
Useful gains	564.0808	637.8055	664.3875	647.0052	558.0581	404.2022	278.1767	289.3708	417.8508	521.4853	539.5796	541.1539	(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	1057.6434	1039.1904	952.9189	804.6493	624.6754	422.7079	283.0549	296.3086	455.6100	679.3662	882.6959	1049.3339	(97)
Space heating kWh	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(98a)
Space heating requirement - total per year (kWh/year)												1757.2686	
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	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1757.2686	
Space heating per m2										(98c) / (4) =		23.7469	(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	367.2106	269.7307	214.6673	113.5038	49.5633	0.0000	0.0000	0.0000	0.0000	117.4634	247.0437	378.0859	(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)	397.4141	291.9163	232.3239	122.8396	53.6399	0.0000	0.0000	0.0000	0.0000	127.1249	267.3634	409.1839	(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	226.9430	200.7498	213.6098	188.8621	183.7347	166.2948	164.7595	170.9601	172.4344	191.3745	202.3436	224.6251	(64)

Efficiency of water heater												80.3000 (216)
(217)m	85.4063	85.0150	84.3920	83.3259	81.9849	80.3000	80.3000	80.3000	80.3000	83.3674	84.8102	85.4878 (217)
Fuel for water heating, kWh/month												
	265.7218	236.1346	253.1161	226.6548	224.1079	207.0919	205.1799	212.9017	214.7378	229.5557	238.5840	262.7569 (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	21.6356	17.3569	15.6280	11.4497	8.8441	7.2257	8.0679	10.4869	13.6215	17.8721	20.1865	22.2370 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.3754	-24.5457	-37.4855	-44.8657	-50.7916	-48.2957	-47.7057	-43.8293	-37.4345	-29.2341	-18.5129	-13.9924 (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	-5.2947	-11.4338	-23.2891	-35.8243	-48.2107	-48.7528	-48.1818	-40.4091	-29.1150	-16.6263	-7.1556	-4.1654 (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	1901.8058 (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	2776.5430 (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)	174.6121 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-731.5271 (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	4207.4339 (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	1901.8058	0.2100	399.3792	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2776.5430	0.2100	583.0740	(264)
Space and water heating			982.4533	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	174.6121	0.1443	25.2019	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-413.0685	0.1333	-55.0708	
PV Unit electricity exported	-318.4586	0.1252	-39.8716	
Total			-94.9424	(269)
Total CO2, kg/year			924.6420	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5000	(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	1901.8058	1.1300	2149.0406	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2776.5430	1.1300	3137.4936	(278)
Space and water heating			5286.5342	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	174.6121	1.5338	267.8258	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-413.0685	1.4927	-616.5711	
PV Unit electricity exported	-318.4586	0.4595	-146.3455	
Total			-762.9166	(283)
Total Primary energy kWh/year			4921.5443	(286)
Target Primary Energy Rate (TPER)			66.5100	(287)

Full SAP Calculation Printout

Property Reference	Flat 304 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 304 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	14.95	TER	15.65
Environmental	90 B	% DER < TER			4.47
CO_2 Emissions (t/year)	0.7	DFEE	36.78	TFEE	36.44
Compliance Check	See BREL	% DFEE < TFEE			-0.94
% DPER < TPER	-3.53	DPER	86.32	TPER	83.38

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000	(1b)	x 2.8300	(2b) =	147.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		147.1600	(5)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			15.1600	0.9152	13.8748			(27)
Window (Uw = 0.95)			0.9000	0.9152	0.8237			(27)
Door			1.8900	0.8000	1.5120			(26)

External Wall 1	55.1900	17.9500	37.2400	0.1500	5.5860	14.0000	521.3600 (29a)
Total net area of external elements Aum(A, m2)			55.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.7965		(33)
Party Wall 1			25.5000	0.0000	0.0000	20.0000	510.0000 (32)
Party Floor 1			52.0000			40.0000	2080.0000 (32d)
Party Ceiling 1			52.0000			30.0000	1560.0000 (32b)
Internal Wall 1			51.0500			9.0000	459.4500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5130.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		98.6694 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	39.0000	0.0700	2.7300
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.4430	2.5251
E16 Corner (normal)	8.4900	0.0900	0.7641
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	5.6600	0.0600	0.3396
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.0100	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	9.0100	0.1600	1.4416
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)		9.5747 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	31.3712 (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	10.9373	10.7961	10.6550	9.9493	9.8082	9.1025	9.1025	8.9614	9.3848	9.8082	10.0904	10.3727	(38)
Heat transfer coeff	42.3084	42.1673	42.0261	41.3205	41.1793	40.4736	40.4736	40.3325	40.7559	41.1793	41.4616	41.7439	(39)
Average = Sum(39)m / 12 =												41.2852	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8136	0.8109	0.8082	0.7946	0.7919	0.7783	0.7783	0.7756	0.7838	0.7919	0.7973	0.8028	(40)
HLP (average)												0.7939	
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	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)

---

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	(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	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)

---

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	33.6866	33.7993	33.9128	34.4920	34.6102	35.2137	35.2137	35.3369	34.9698	34.6102	34.3746	34.1421	
alpha	3.2458	3.2533	3.2609	3.2995	3.3073	3.3476	3.3476	3.3558	3.3313	3.3073	3.2916	3.2761	
util living area													
	0.9092	0.8694	0.8039	0.6742	0.5186	0.3674	0.2700	0.3083	0.4989	0.7378	0.8678	0.9174	(86)
MIT	19.6028	19.8815	20.2436	20.6522	20.8794	20.9717	20.9924	20.9882	20.9223	20.6055	20.0653	19.5642	(87)
Th 2	20.2415	20.2439	20.2462	20.2580	20.2604	20.2721	20.2721	20.2745	20.2674	20.2604	20.2556	20.2509	(88)
util rest of house													
	0.8992	0.8560	0.7848	0.6466	0.4840	0.3280	0.2262	0.2612	0.4531	0.7074	0.8521	0.9083	(89)
MIT 2	18.6083	18.9540	19.3977	19.8893	20.1443	20.2493	20.2674	20.2669	20.2005	19.8492	19.1962	18.5670	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	19.1778	19.4852	19.8821	20.3262	20.5653	20.6630	20.6826	20.6800	20.6139	20.2823	19.6939	19.1381	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0278	19.3352	19.7321	20.1762	20.4153	20.5130	20.5326	20.5300	20.4639	20.1323	19.5439	18.9881	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8804	0.8377	0.7706	0.6435	0.4914	0.3412	0.2419	0.2779	0.4657	0.7018	0.8350	0.8899	(94)
Useful gains	382.1368	413.7972	422.5995	403.6763	337.5707	234.7243	158.1000	164.8784	246.4939	324.2924	355.0744	370.6785	(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													
	623.1104	608.6924	556.0943	465.9387	358.8894	239.3220	159.1671	166.5718	259.3662	392.5351	515.9448	617.3122	(97)
Space heating kWh													
	179.2844	130.9696	99.3201	44.8289	15.8611	0.0000	0.0000	0.0000	0.0000	50.7726	115.8267	183.4955	(98a)
Space heating requirement - total per year (kWh/year)												820.3587	
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													
	179.2844	130.9696	99.3201	44.8289	15.8611	0.0000	0.0000	0.0000	0.0000	50.7726	115.8267	183.4955	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												820.3587	
Space heating per m2											(98c) / (4) =	15.7761	(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													
	179.2844	130.9696	99.3201	44.8289	15.8611	0.0000	0.0000	0.0000	0.0000	50.7726	115.8267	183.4955	(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)													
	200.3178	146.3347	110.9722	50.0881	17.7219	0.0000	0.0000	0.0000	0.0000	56.7291	129.4153	205.0229	(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	22.4303	20.2596	22.4303	21.7068	22.4303	21.7068	22.4303	22.4303	21.7068	22.4303	21.7068	22.4303 (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	916.6019 (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)	178.0989 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	264.0989 (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	3834.1658 (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	916.6019	0.2100	192.4864	(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			721.0833	(265)
Pumps, fans and electric keep-hot	264.0989	0.1387	36.6338	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			777.3947	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.9500	(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	916.6019	1.1300	1035.7602	(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			3880.1150	(279)
Pumps, fans and electric keep-hot	264.0989	1.5128	399.5288	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			4488.7617	(286)
Dwelling Primary energy Rate (DPER)			86.3200	(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	2.8300 (2b) =	147.1600 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	147.1600 (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) =	0.1359	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3859	(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) =	0.2991	(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	0.3813	0.3738	0.3664	0.3290	0.3215	0.2841	0.2841	0.2766	0.2991	0.3215	0.3365	0.3514	(22b)
Effective ac	0.5727	0.5699	0.5671	0.5541	0.5517	0.5404	0.5404	0.5383	0.5447	0.5517	0.5566	0.5617	(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)
External Wall 1	55.1900	12.9900	42.2000	0.1800	7.5960			(29a)
Total net area of external elements Aum(A, m2)			55.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.1959			(33)
Party Wall 1			25.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 108.6694 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	39.0000	0.0700	2.7300
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.7000	0.0200	0.1140
E16 Corner (normal)	8.4900	0.0900	0.7641
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	5.6600	0.0600	0.3396
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.0100	0.0000	0.0000
P7 Party Wall - Exposed floor (normal)	9.0100	0.1600	1.4416
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) 7.1636 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.3595 (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	27.8121	27.6750	27.5406	26.9094	26.7913	26.2415	26.2415	26.1397	26.4533	26.7913	27.0302	27.2800	(38)
Heat transfer coeff	57.1716	57.0345	56.9001	56.2689	56.1508	55.6011	55.6011	55.4993	55.8128	56.1508	56.3897	56.6395	(39)

Average = Sum(39)m / 12 = 56.2684

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0995	1.0968	1.0942	1.0821	1.0798	1.0693	1.0693	1.0673	1.0733	1.0798	1.0844	1.0892	(40)

HLP (average)												1.0821
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)

	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													
	77.0119	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)

---

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)

---

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	27.4554	27.5214	27.5864	27.8958	27.9545	28.2309	28.2309	28.2827	28.1238	27.9545	27.8361	27.7133	
alpha	2.8304	2.8348	2.8391	2.8597	2.8636	2.8821	2.8821	2.8855	2.8749	2.8636	2.8557	2.8476	
util living area													
	0.9397	0.9151	0.8731	0.7816	0.6486	0.4925	0.3734	0.4209	0.6277	0.8268	0.9141	0.9452	(86)
MIT	18.9124	19.2036	19.6416	20.2140	20.6438	20.8839	20.9612	20.9449	20.7607	20.2000	19.4769	18.8661	(87)
Th 2	20.0013	20.0034	20.0055	20.0155	20.0173	20.0260	20.0260	20.0276	20.0227	20.0173	20.0136	20.0096	(88)
util rest of house													
	0.9310	0.9032	0.8552	0.7517	0.6026	0.4293	0.2965	0.3404	0.5645	0.7957	0.9001	0.9373	(89)
MIT 2	17.5820	17.9469	18.4915	19.1891	19.6816	19.9378	20.0049	19.9956	19.8239	19.1919	18.3023	17.5292	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	18.3439	18.6666	19.1502	19.7760	20.2326	20.4796	20.5526	20.5392	20.3604	19.7693	18.9750	18.2948	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3439	18.6666	19.1502	19.7760	20.2326	20.4796	20.5526	20.5392	20.3604	19.7693	18.9750	18.2948	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9127	0.8837	0.8372	0.7437	0.6132	0.4595	0.3387	0.3836	0.5874	0.7868	0.8820	0.9197	(94)
Useful gains	392.3927	429.4908	448.1172	451.6839	405.4248	303.6755	212.7169	219.5620	301.8396	356.1678	370.5438	379.9453	(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													
	802.9134	785.1730	719.7980	611.9836	479.1129	326.9123	219.7667	229.7249	349.4113	514.8612	669.6276	798.3249	(97)
Space heating kWh													
	305.4274	239.0184	202.1305	115.4158	54.8239	0.0000	0.0000	0.0000	0.0000	118.0679	215.3404	311.2744	(98a)
Space heating requirement - total per year (kWh/year)												1561.4988	
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													
	305.4274	239.0184	202.1305	115.4158	54.8239	0.0000	0.0000	0.0000	0.0000	118.0679	215.3404	311.2744	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1561.4988	
Space heating per m2											(98c) / (4) =	30.0288	(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													
	305.4274	239.0184	202.1305	115.4158	54.8239	0.0000	0.0000	0.0000	0.0000	118.0679	215.3404	311.2744	(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)													
	330.5492	258.6779	218.7560	124.9088	59.3333	0.0000	0.0000	0.0000	0.0000	127.7791	233.0524	336.8771	(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	85.2910	85.0304	84.5344	83.6057	82.3220	80.3000	80.3000	80.3000	80.3000	83.6217	84.7849	85.3513	(217)
Fuel for water heating, kWh/month													
	233.8881	207.7027	222.6714	199.7060	195.6990	179.7386	177.3695	185.6805	188.8679	202.6586	210.4947	231.4309	(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	-14.0683	-20.9173	-31.6975	-37.6497	-42.3904	-40.2476	-39.7772	-36.6675	-31.4862	-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	-21.6855	-33.2267	-44.5711	-44.9977	-44.4483	-37.3257	-26.9694	-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												1689.9337	(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	2435.9079 (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	-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	3698.4257 (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	1689.9337	0.2100	354.8861	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2435.9079	0.2100	511.5407	(264)
Space and water heating			866.4268	(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	-347.6041	0.1335	-46.3926	
PV Unit electricity exported	-294.9534	0.1253	-36.9657	
Total			-83.3582	(269)
Total CO2, kg/year			813.6369	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6500	(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	1689.9337	1.1300	1909.6251	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2435.9079	1.1300	2752.5760	(278)
Space and water heating			4662.2011	(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	-347.6041	1.4932	-519.0409	
PV Unit electricity exported	-294.9534	0.4600	-135.6817	
Total			-654.7226	(283)
Total Primary energy kWh/year			4335.6610	(286)
Target Primary Energy Rate (TPER)			83.3800	(287)

Full SAP Calculation Printout

Property Reference	Flat 305 VL - Be Lean	Issued on Date	06/05/2023
Assessment Reference	Flat 305 VL - Be Lean	Prop Type Ref	Flat 103 VL - Be Lean
Property	MFMTF, Vine Lane, London, WC1A		

SAP Rating	83 B	DER	15.79	TER	16.87
Environmental	89 B	% DER < TER			6.40
CO_2 Emissions (t/year)	0.73	DFEE	40.78	TFEE	40.48
Compliance Check	See BREL	% DFEE < TFEE			-0.76
% DPER < TPER	-0.50	DPER	90.83	TPER	90.38

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000	(1b)	x 2.8300	(2b) =	147.1600	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		147.1600	(5)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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)
Total net area of external elements Aum(A, m2)			81.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.9387		(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)
Party Ceiling 1			52.0000			30.0000	1560.0000 (32b)
Internal Wall 1			58.0200			9.0000	522.1800 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5212.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.2388 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	57.7000	0.0700	4.0390
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.4430	1.9049
E16 Corner (normal)	11.3200	0.0900	1.0188
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	2.8300	0.0600	0.1698
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.0000	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

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0628 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 37.0015 (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	10.9373	10.7961	10.6550	9.9493	9.8082	9.1025	9.1025	8.9614	9.3848	9.8082	10.0904	10.3727	(38)
Heat transfer coeff	47.9387	47.7976	47.6565	46.9508	46.8097	46.1040	46.1040	45.9628	46.3862	46.8097	47.0919	47.3742	(39)
Average = Sum(39)m / 12 =												46.9155	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9219	0.9192	0.9165	0.9029	0.9002	0.8866	0.8866	0.8839	0.8920	0.9002	0.9056	0.9110	(40)
HLP (average)												0.9022	
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	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)

---

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	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													
	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	30.2030	30.2922	30.3819	30.8386	30.9315	31.4050	31.4050	31.5014	31.2139	30.9315	30.7461	30.5629	
alpha	3.0135	3.0195	3.0255	3.0559	3.0621	3.0937	3.0937	3.1001	3.0809	3.0621	3.0497	3.0375	
util living area													
	0.9108	0.8674	0.7991	0.6719	0.5207	0.3730	0.2749	0.3131	0.5011	0.7376	0.8698	0.9197	(86)
MIT	19.3717	19.7016	20.1156	20.5728	20.8406	20.9582	20.9878	20.9818	20.8959	20.5191	19.8909	19.3199	(87)
Th 2	20.1489	20.1512	20.1535	20.1650	20.1673	20.1789	20.1789	20.1812	20.1743	20.1673	20.1627	20.1581	(88)
util rest of house													
	0.9003	0.8528	0.7783	0.6419	0.4825	0.3285	0.2249	0.2596	0.4504	0.7045	0.8532	0.9102	(89)
MIT 2	18.2558	18.6641	19.1702	19.7173	20.0165	20.1461	20.1717	20.1699	20.0868	19.6723	18.9144	18.1978	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	18.9483	19.3080	19.7569	20.2482	20.5279	20.6501	20.6782	20.6737	20.5889	20.1978	19.5204	18.8942	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7983	19.1580	19.6069	20.0982	20.3779	20.5001	20.5282	20.5237	20.4389	20.0478	19.3704	18.7442	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8803	0.8333	0.7635	0.6394	0.4924	0.3461	0.2463	0.2822	0.4670	0.6994	0.8350	0.8907	(94)
Useful gains	403.5934	446.2116	461.8585	445.6614	376.4874	264.7568	179.2579	186.7168	275.7425	355.2486	379.4535	389.6241	(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													
	695.0302	681.4960	624.6279	525.7631	406.2113	272.0160	181.1045	189.5386	294.0383	442.2492	577.8352	689.0190	(97)
Space heating kWh													
	216.8290	158.1111	121.1004	57.6732	22.1146	0.0000	0.0000	0.0000	0.0000	64.7285	142.8348	222.7498	(98a)
Space heating requirement - total per year (kWh/year)												1006.1414	
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													
	216.8290	158.1111	121.1004	57.6732	22.1146	0.0000	0.0000	0.0000	0.0000	64.7285	142.8348	222.7498	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1006.1414	
Space heating per m2											(98c) / (4) =	19.3489	(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													
	216.8290	158.1111	121.1004	57.6732	22.1146	0.0000	0.0000	0.0000	0.0000	64.7285	142.8348	222.7498	(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)													
	242.2670	176.6605	135.3077	64.4393	24.7091	0.0000	0.0000	0.0000	0.0000	72.3223	159.5920	248.8825	(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 22.4303 20.2596 22.4303 21.7068 22.4303 21.7068 22.4303 22.4303 21.7068 22.4303 21.7068 22.4303 (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 1124.1804 (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) 178.0989 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 264.0989 (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 4041.7442 (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	1124.1804	0.2100	236.0779	(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			764.6748	(265)
Pumps, fans and electric keep-hot	264.0989	0.1387	36.6338	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			820.9862	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.7900	(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	1124.1804	1.1300	1270.3238	(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			4114.6787	(279)
Pumps, fans and electric keep-hot	264.0989	1.5128	399.5288	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			4723.3254	(286)
Dwelling Primary energy Rate (DPER)			90.8300	(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	52.0000 (1b)	x	2.8300 (2b)	=	147.1600 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	147.1600	(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) =	0.1359	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3859	(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) =	0.2991	(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	0.3813	0.3738	0.3664	0.3290	0.3215	0.2841	0.2841	0.2766	0.2991	0.3215	0.3365	0.3514	(22b)
Effective ac	0.5727	0.5699	0.5671	0.5541	0.5517	0.5404	0.5404	0.5383	0.5447	0.5517	0.5566	0.5617	(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)
External Wall 1	81.6500	13.0000	68.6500	0.1800	12.3570			(29a)
Total net area of external elements Aum(A, m2)			81.6500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.9684			(33)
Party Wall 1			9.9100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 110.2388 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E7 Party floor between dwellings (in blocks of flats)	57.7000	0.0700	4.0390
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	4.3000	0.0200	0.0860
E16 Corner (normal)	11.3200	0.0900	1.0188
E17 Corner (inverted – internal area greater than external area)	2.8300	-0.0900	-0.2547
E18 Party wall between dwellings	2.8300	0.0600	0.1698
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.0000	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

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.2439 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 34.2123 (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	27.8121	27.6750	27.5406	26.9094	26.7913	26.2415	26.2415	26.1397	26.4533	26.7913	27.0302	27.2800	(38)
Heat transfer coeff	62.0244	61.8873	61.7529	61.1217	61.0036	60.4538	60.4538	60.3520	60.6656	61.0036	61.2425	61.4923	(39)
Average = Sum(39)m / 12 =												61.1211	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1901	1.1876	1.1754	1.1731	1.1626	1.1626	1.1606	1.1666	1.1731	1.1777	1.1825	(40)
HLP (average)												1.1754	
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	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)

---
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	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	25.6728	25.7297	25.7857	26.0519	26.1024	26.3398	26.3398	26.3842	26.2478	26.1024	26.0006	25.8949	

alpha	2.7115	2.7153	2.7190	2.7368	2.7402	2.7560	2.7560	2.7589	2.7499	2.7402	2.7334	2.7263	
util living area													
	0.9408	0.9158	0.8755	0.7911	0.6671	0.5158	0.3941	0.4397	0.6401	0.8306	0.9157	0.9463	(86)
MIT	18.7382	19.0480	19.5048	20.0996	20.5673	20.8484	20.9469	20.9273	20.7145	20.1076	19.3358	18.6867	(87)
Th 2	19.9258	19.9279	19.9300	19.9397	19.9415	19.9501	19.9501	19.9516	19.9468	19.9415	19.9378	19.9340	(88)
util rest of house													
	0.9319	0.9035	0.8570	0.7602	0.6188	0.4467	0.3080	0.3507	0.5731	0.7982	0.9013	0.9382	(89)
MIT 2	17.3165	17.7045	18.2726	18.9985	19.5368	19.8367	19.9221	19.9107	19.7132	19.0284	18.0786	17.2569	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	18.1988	18.5383	19.0373	19.6818	20.1763	20.4645	20.5580	20.5416	20.3346	19.6981	18.8588	18.1442	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1988	18.5383	19.0373	19.6818	20.1763	20.4645	20.5580	20.5416	20.3346	19.6981	18.8588	18.1442	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9134	0.8838	0.8388	0.7519	0.6301	0.4815	0.3588	0.4020	0.5991	0.7897	0.8832	0.9205	(94)
Useful gains	402.9033	444.9092	465.3334	469.3765	424.3747	322.7576	229.0064	235.7393	319.0441	371.7765	382.5783	389.2671	(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													
	862.0618	844.0366	774.2132	659.0036	517.0851	354.5331	239.2784	249.9518	378.2251	555.0176	720.1381	857.4587	(97)
Space heating kWh													
	341.6140	268.2136	229.8066	136.5315	68.9766	0.0000	0.0000	0.0000	0.0000	136.3314	243.0431	348.3346	(98a)
Space heating requirement - total per year (kWh/year)												1772.8513	
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													
	341.6140	268.2136	229.8066	136.5315	68.9766	0.0000	0.0000	0.0000	0.0000	136.3314	243.0431	348.3346	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1772.8513	
Space heating per m2											(98c) / (4) =	34.0933	(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													
	341.6140	268.2136	229.8066	136.5315	68.9766	0.0000	0.0000	0.0000	0.0000	136.3314	243.0431	348.3346	(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)													
	369.7121	290.2745	248.7084	147.7614	74.6500	0.0000	0.0000	0.0000	0.0000	147.5449	263.0336	376.9855	(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	85.5232	85.2740	84.8101	83.9535	82.6984	80.3000	80.3000	80.3000	80.3000	83.9193	85.0437	85.5832	(217)
Fuel for water heating, kWh/month													
	233.2531	207.1093	221.9475	198.8785	194.8083	179.7386	177.3695	185.6805	188.8679	201.9399	209.8543	230.8037	(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												1918.6703	(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												2430.2513	(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	4050.0105 (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	1918.6703	0.2100	402.9208	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2430.2513	0.2100	510.3528	(264)
Space and water heating			913.2735	(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			877.1023	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.8700	(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	1918.6703	1.1300	2168.0974	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2430.2513	1.1300	2746.1839	(278)
Space and water heating			4914.2813	(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			4699.6903	(286)
Target Primary Energy Rate (TPER)			90.3800	(287)

Full SAP Calculation Printout

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

SAP Rating	82 B	DER	16.62	TER	16.90
Environmental	89 B	% DER < TER			1.66
CO_2 Emissions (t/year)	0.74	DFEE	43.84	TFEE	39.52
Compliance Check	See BREL	% DFEE < TFEE			-10.94
% DPER < TPER	-5.29	DPER	95.37	TPER	90.58

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

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000	(1b)	x 2.7700	(2b) =	138.5000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		138.5000	(5)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			11.5800	0.9152	10.5983			(27)
Window (Uw = 0.95)			11.2800	0.9152	10.3237			(27)
Door			1.8900	0.8000	1.5120			(26)

External Wall 1	69.6900	24.7500	44.9400	0.1500	6.7410	14.0000	629.1600 (29a)
Total net area of external elements Aum(A, m2)			69.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.1750		(33)
Party Wall 1			14.6800	0.0000	0.0000	20.0000	293.6000 (32)
Party Floor 1			50.0000			40.0000	2000.0000 (32d)
Party Ceiling 1			50.0000			30.0000	1500.0000 (32b)
Internal Wall 1			53.7400			9.0000	483.6600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4906.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.1284 (35)
List of Thermal Bridges

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

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4906 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6655 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.2936	10.1608	10.0280	9.3638	9.2310	8.5668	8.5668	8.4340	8.8325	9.2310	9.4966	9.7623	(38)
Heat transfer coeff	48.9592	48.8263	48.6935	48.0293	47.8965	47.2324	47.2324	47.0995	47.4980	47.8965	48.1622	48.4278	(39)
Average = Sum(39)m / 12 =												47.9961	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9792	0.9765	0.9739	0.9606	0.9579	0.9446	0.9446	0.9420	0.9500	0.9579	0.9632	0.9686	(40)
HLP (average)												0.9599	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

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

Hot water usage for baths

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

Hot water usage for other uses

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
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	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(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	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(64)
										Total per year (kWh/year) = Sum(64)m =		2216.1948	(64)
12Total per year (kWh/year)												2216	(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	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(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	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)												
	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557 (72)
Total internal gains												
	365.8608	373.3878	357.8095	343.4627	324.9879	308.8126	296.3460	297.9790	307.9545	323.2136	344.1443	358.3074 (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	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)
Northwest	9.6000	11.2829	0.4700	0.7000	0.7700	24.6958 (81)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)

Solar gains	70.3233	137.6280	235.6986	371.4747	488.5852	516.9434	485.1169	392.8716	281.9482	164.8858	87.4802	58.0797 (83)
Total gains	436.1841	511.0158	593.5081	714.9375	813.5731	825.7561	781.4629	690.8506	589.9027	488.0994	431.6244	416.3871 (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	27.8374	27.9131	27.9892	28.3763	28.4550	28.8551	28.8551	28.9365	28.6937	28.4550	28.2980	28.1428	
alpha	2.8558	2.8609	2.8659	2.8918	2.8970	2.9237	2.9237	2.9291	2.9129	2.8970	2.8865	2.8762	
util living area													
	0.9149	0.8741	0.8018	0.6619	0.4997	0.3535	0.2619	0.3063	0.5060	0.7509	0.8777	0.9232	(86)
MIT	19.1636	19.5092	19.9881	20.5232	20.8279	20.9540	20.9858	20.9776	20.8704	20.4179	19.7173	19.1094	(87)
Th 2	20.1007	20.1029	20.1052	20.1163	20.1185	20.1297	20.1297	20.1320	20.1252	20.1185	20.1141	20.1096	(88)
util rest of house													
	0.9046	0.8597	0.7806	0.6308	0.4606	0.3087	0.2115	0.2510	0.4529	0.7175	0.8614	0.9138	(89)
MIT 2	17.9669	18.3956	18.9814	19.6189	19.9570	20.0941	20.1215	20.1183	20.0169	19.5188	18.6700	17.9053	(90)
Living area fraction									fLA = Living area / (4) =			0.6250	(91)
MIT	18.7148	19.0916	19.6106	20.1841	20.5013	20.6315	20.6617	20.6554	20.5503	20.0808	19.3246	18.6579	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5648	18.9416	19.4606	20.0341	20.3513	20.4815	20.5117	20.5054	20.4003	19.9308	19.1746	18.5079	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8831	0.8381	0.7636	0.6277	0.4712	0.3271	0.2338	0.2750	0.4701	0.7098	0.8411	0.8929	(94)
Useful gains	385.1818	428.2821	453.2256	448.7937	383.3328	270.0644	182.6704	189.9971	277.2887	346.4403	363.0342	371.7853	(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													
	698.3941	685.5991	631.0962	534.7613	414.3675	277.7994	184.7590	193.3611	299.2524	446.9106	581.5370	692.8993	(97)
Space heating kWh													
	233.0299	172.9170	132.3357	61.8967	23.0898	0.0000	0.0000	0.0000	0.0000	74.7499	157.3220	238.9088	(98a)
Space heating requirement - total per year (kWh/year)												1094.2499	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	233.0299	172.9170	132.3357	61.8967	23.0898	0.0000	0.0000	0.0000	0.0000	74.7499	157.3220	238.9088	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1094.2499	
Space heating per m2											(98c) / (4) =	21.8850	(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													
	233.0299	172.9170	132.3357	61.8967	23.0898	0.0000	0.0000	0.0000	0.0000	74.7499	157.3220	238.9088	(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)													
	260.3686	193.2034	147.8611	69.1583	25.7987	0.0000	0.0000	0.0000	0.0000	83.5194	175.7787	266.9372	(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
220.7687 195.4477 207.9495 182.3063 175.2988 156.3578 153.5698 160.9934 164.0619 184.6518 196.3856 218.4034 (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
246.6689 218.3773 232.3458 203.6942 195.8646 174.7015 171.5864 179.8809 183.3094 206.3149 219.4253 244.0262 (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 21.5402 19.4556 21.5402 20.8453 21.5402 20.8453 21.5402 21.5402 20.8453 21.5402 20.8453 21.5402 (231)
Lighting 16.5676 13.2912 11.9672 8.7677 6.7724 5.5331 6.1780 8.0304 10.4307 13.6857 15.4580 17.0281 (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 1222.6255 (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 2476.1953 (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) 167.6182 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 253.6182 (231)
Electricity for lighting (calculated in Appendix L) 133.7101 (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 4086.1492 (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	1222.6255	0.2100	256.7514	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2476.1953	0.2100	520.0010	(264)
Space and water heating			776.7524	(265)
Pumps, fans and electric keep-hot	253.6182	0.1387	35.1800	(267)
Energy for lighting	133.7101	0.1443	19.2985	(268)
Total CO2, kg/year			831.2309	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.6200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1222.6255	1.1300	1381.5669	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2476.1953	1.1300	2798.1007	(278)
Space and water heating			4179.6676	(279)
Pumps, fans and electric keep-hot	253.6182	1.5128	383.6737	(281)
Energy for lighting	133.7101	1.5338	205.0890	(282)
Total Primary energy kWh/year			4768.4303	(286)
Dwelling Primary energy Rate (DPER)			95.3700	(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	50.0000 (1b)	x	2.7700 (2b)	=	138.5000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	138.5000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1444	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3944	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3897	0.3821	0.3744	0.3362	0.3286	0.2904	0.2904	0.2827	0.3057	0.3286	0.3439	0.3592	(22b)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			10.6200	1.1450	12.1603			(27)
External Wall 1	69.6900	12.5100	57.1800	0.1800	10.2924			(29a)
Total net area of external elements Aum(A, m2)			69.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.3427			(33)
Party Wall 1			14.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 108.1284 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E7 Party floor between dwellings (in blocks of flats)	50.3200	0.0700	3.5224
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	6.1900	0.0200	0.1238
E16 Corner (normal)	8.3100	0.0900	0.7479
E17 Corner (inverted – internal area greater than external area)	2.7700	-0.0900	-0.2493
E18 Party wall between dwellings	5.5400	0.0600	0.3324
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.6000	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	10.5000	0.0500	0.5250
E3 Sill	9.6000	0.0500	0.4800
E4 Jamb	27.8000	0.0500	1.3900

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.8722	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	31.2149	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.3234	26.1886	26.0565	25.4360	25.3199	24.7794	24.7794	24.6794	24.9876	25.3199	25.5547	25.8003	(38)
Heat transfer coeff	57.5383	57.4035	57.2714	56.6509	56.5348	55.9943	55.9943	55.8943	56.2025	56.5348	56.7697	57.0152	(39)
Average = Sum(39)m / 12 =												56.6503	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1508	1.1481	1.1454	1.1330	1.1307	1.1199	1.1199	1.1179	1.1241	1.1307	1.1354	1.1403	(40)
HLP (average)												1.1330	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers													
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths													
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
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	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
										Total per year (kWh/year) = Sum(64)m =		1992.9475	(64)
12Total per year (kWh/year)												1993	(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													
	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.4107	82.3832	74.4107	76.8910	74.4107	76.8910	74.4107	74.4107	76.8910	74.4107	76.8910	74.4107	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	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)													
	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains													
	366.0088	373.5517	357.9576	343.6157	325.1360	308.9656	296.4941	298.1271	308.1075	323.3617	344.2972	358.4555	(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	5.2400	11.2829	0.6300	0.7000	0.7700	18.0686	(75)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
Northwest	4.4600	11.2829	0.6300	0.7000	0.7700	15.3790	(81)

Solar gains	43.7928	85.7052	146.7757	231.3256	304.2518	321.9107	302.0918	244.6495	175.5761	102.6792	54.4769	36.1683	(83)
Total gains	409.8016	459.2570	504.7333	574.9413	629.3878	630.8763	598.5859	542.7766	483.6836	426.0409	398.7741	394.6238	(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	26.1006	26.1619	26.2222	26.5094	26.5639	26.8203	26.8203	26.8683	26.7209	26.5639	26.4540	26.3401	

alpha	2.7400	2.7441	2.7481	2.7673	2.7709	2.7880	2.7880	2.7912	2.7814	2.7709	2.7636	2.7560	
util living area	0.9421	0.9204	0.8819	0.7954	0.6657	0.5106	0.3905	0.4408	0.6500	0.8396	0.9188	0.9471	(86)
MIT	18.7655	19.0487	19.4995	20.1078	20.5822	20.8577	20.9504	20.9298	20.7120	20.0989	19.3484	18.7214	(87)
Th 2	19.9596	19.9618	19.9639	19.9740	19.9758	19.9846	19.9846	19.9863	19.9812	19.9758	19.9720	19.9681	(88)
util rest of house	0.9336	0.9089	0.8645	0.7657	0.6188	0.4440	0.3077	0.3545	0.5850	0.8091	0.9051	0.9392	(89)
MIT 2	17.3735	17.7291	18.2912	19.0351	19.5821	19.8768	19.9578	19.9458	19.7418	19.0452	18.1179	17.3233	(90)
Living area fraction										fLA = Living area / (4) =		0.6250	(91)
MIT	18.2435	18.5539	19.0464	19.7055	20.2072	20.4898	20.5782	20.5608	20.3482	19.7038	18.8869	18.1971	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2435	18.5539	19.0464	19.7055	20.2072	20.4898	20.5782	20.5608	20.3482	19.7038	18.8869	18.1971	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9155	0.8896	0.8464	0.7571	0.6300	0.4780	0.3569	0.4045	0.6097	0.7999	0.8873	0.9219	(94)
Useful gains	375.1788	408.5398	427.2053	435.3109	396.4898	301.5803	213.6517	219.5620	294.9142	340.7761	353.8246	363.7929	(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	802.2837	783.7790	718.5514	612.1428	480.9502	329.7974	222.7549	232.5646	351.1648	514.6792	669.1409	798.0492	(97)
Space heating kWh	317.7660	252.1608	216.7615	127.3190	62.8385	0.0000	0.0000	0.0000	0.0000	129.3839	227.0277	323.0867	(98a)
Space heating requirement - total per year (kWh/year)												1656.3441	
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	317.7660	252.1608	216.7615	127.3190	62.8385	0.0000	0.0000	0.0000	0.0000	129.3839	227.0277	323.0867	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1656.3441	
Space heating per m2											(98c) / (4) =	33.1269	(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	317.7660	252.1608	216.7615	127.3190	62.8385	0.0000	0.0000	0.0000	0.0000	129.3839	227.0277	323.0867	(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)	343.9026	272.9013	234.5904	137.7911	68.0071	0.0000	0.0000	0.0000	0.0000	140.0259	245.7010	349.6609	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.4025	85.1731	84.7138	83.8464	82.5716	80.3000	80.3000	80.3000	80.3000	83.8440	84.9270	85.4572	(217)
Fuel for water heating, kWh/month	230.3701	204.5226	219.2066	195.4544	191.5035	176.4186	174.0932	182.2506	185.3789	198.8570	207.3333	227.9756	(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	15.4611	12.4034	11.1679	8.1821	6.3201	5.1636	5.7654	7.4941	9.7341	12.7716	14.4255	15.8908	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.1921	-16.8466	-25.8400	-31.0772	-35.3303	-33.6675	-33.2750	-30.5091	-25.9536	-20.1440	-12.6830	-9.5570	(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	-3.4498	-7.4638	-15.2239	-23.4431	-31.5631	-31.9058	-31.5138	-26.4087	-19.0123	-10.8428	-4.6606	-2.7118	(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												1792.5802	(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												2393.3645	(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)	124.7797 (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	3902.4493 (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	1792.5802	0.2100	376.4418	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2393.3645	0.2100	502.6065	(264)
Space and water heating			879.0484	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.7797	0.1443	18.0096	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0755	0.1332	-38.1104	
PV Unit electricity exported	-208.1996	0.1252	-26.0637	
Total			-64.1742	(269)
Total CO2, kg/year			844.8130	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.9000	(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	1792.5802	1.1300	2025.6157	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2393.3645	1.1300	2704.5018	(278)
Space and water heating			4730.1175	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.7797	1.5338	191.3912	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0755	1.4923	-426.9027	
PV Unit electricity exported	-208.1996	0.4595	-95.6649	
Total			-522.5677	(283)
Total Primary energy kWh/year			4529.0418	(286)
Target Primary Energy Rate (TPER)			90.5800	(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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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		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)

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

---

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			10.4400	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	29.7945	29.4176	29.0406	27.1559	26.7790	24.8943	24.8943	24.5173	25.6482	26.7790	27.5329	28.2867	(38)
Heat transfer coeff	132.3515	131.9745	131.5976	129.7129	129.3360	127.4513	127.4513	127.0743	128.2051	129.3360	130.0898	130.8437	(39)
Average = Sum(39)m / 12 =												129.6187	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9591	0.9563	0.9536	0.9399	0.9372	0.9236	0.9236	0.9208	0.9290	0.9372	0.9427	0.9481	(40)
HLP (average)												0.9393	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9132 (42)
Hot water usage for mixer showers	73.0643	71.9663	70.3662	67.3049	65.0457	62.5262	61.0942	62.6821	64.4227	67.1279	70.2550	72.7843 (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)												137.0301 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.0714	145.8880	142.0114	136.1169	131.3300	126.1838	124.2062	128.0661	132.1369	137.5395	143.5249	148.6848	(44)
Energy conte	236.0926	207.7426	218.2663	186.3372	176.7954	155.1577	150.2167	158.5726	162.9380	186.6398	204.4775	232.8045	(45)
Energy content (annual)										Total = Sum(45)m =		2276.0408	
Distribution loss (46)m = 0.15 x (45)m	35.4139	31.1614	32.7399	27.9506	26.5193	23.2737	22.5325	23.7859	24.4407	27.9960	30.6716	34.9207	(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	287.0515	253.7700	269.2252	235.6523	227.7543	204.4728	201.1756	209.5315	212.2530	237.5987	253.7926	283.7634	(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	287.0515	253.7700	269.2252	235.6523	227.7543	204.4728	201.1756	209.5315	212.2530	237.5987	253.7926	283.7634	(64)
										Total per year (kWh/year) = Sum(64)m =		2876.0408	(64)
12Total per year (kWh/year)												2876	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.2405	80.5813	85.3133	74.2859	71.5242	63.9187	62.6868	65.4651	66.5056	74.7975	80.3175	90.1472	(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	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	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)

	-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)

	122.6351	119.9126	114.6684	103.1748	96.1347	88.7760	84.2564	87.9907	92.3689	100.5342	111.5521	121.1656	(72)

Total internal gains

	654.3692	671.4312	641.5583	618.1310	584.3448	558.8653	535.6309	536.1782	553.7512	576.8502	614.6142	639.3484	(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	2.4400	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	859.2798	1034.1413	1174.1483	1338.9039	1447.2280	1439.9465	1374.9172	1265.7077	1150.9213	987.5135	862.5396	813.0982	(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	24.4519	24.5217	24.5919	24.9493	25.0220	25.3920	25.3920	25.4673	25.2427	25.0220	24.8770	24.7336	
alpha	2.6301	2.6348	2.6395	2.6633	2.6681	2.6928	2.6928	2.6978	2.6828	2.6681	2.6585	2.6489	
util living area													
	0.9474	0.9170	0.8712	0.7819	0.6572	0.5059	0.3855	0.4290	0.6272	0.8281	0.9217	0.9536	(86)
MIT	18.5442	18.9283	19.4395	20.0736	20.5532	20.8443	20.9450	20.9258	20.7101	20.0641	19.2057	18.4861	(87)
Th 2	20.1176	20.1199	20.1222	20.1337	20.1360	20.1475	20.1475	20.1498	20.1429	20.1360	20.1314	20.1268	(88)
util rest of house													
	0.9410	0.9073	0.8563	0.7570	0.6186	0.4513	0.3176	0.3592	0.5740	0.8024	0.9110	0.9479	(89)
MIT 2	17.2177	17.7015	18.3414	19.1246	19.6899	20.0166	20.1122	20.0996	19.8821	19.1318	18.0648	17.1496	(90)
Living area fraction									fLA = Living area / (4) =			0.1300	(91)
MIT	17.3901	17.8610	18.4841	19.2480	19.8022	20.1242	20.2204	20.2070	19.9897	19.2530	18.2131	17.3234	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.2401	17.7110	18.3341	19.0980	19.6522	19.9742	20.0704	20.0570	19.8397	19.1030	18.0631	17.1734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9115	0.8723	0.8182	0.7226	0.5950	0.4396	0.3112	0.3512	0.5534	0.7653	0.8766	0.9204	(94)
Useful gains	783.2736	902.0411	960.6993	967.5045	861.0287	633.0486	427.9405	444.5159	636.8644	755.7074	756.0916	748.4011	(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													
	1712.6427	1690.7223	1557.3417	1322.8065	1028.5010	684.9533	442.3104	464.7159	735.8604	1099.7436	1426.1862	1697.4820	(97)
Space heating kWh													
	691.4506	529.9937	443.9019	255.8174	124.5994	0.0000	0.0000	0.0000	0.0000	255.9629	482.4682	706.1162	(98a)
Space heating requirement - total per year (kWh/year)												3490.3103	
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													
	691.4506	529.9937	443.9019	255.8174	124.5994	0.0000	0.0000	0.0000	0.0000	255.9629	482.4682	706.1162	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3490.3103	
Space heating per m2											(98c) / (4) =	25.2921	(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												

	691.4506	529.9937	443.9019	255.8174	124.5994	0.0000	0.0000	0.0000	0.0000	255.9629	482.4682	706.1162 (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)												
	772.5705	592.1718	495.9798	285.8295	139.2173	0.0000	0.0000	0.0000	0.0000	285.9921	539.0706	788.9567 (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												
	287.0515	253.7700	269.2252	235.6523	227.7543	204.4728	201.1756	209.5315	212.2530	237.5987	253.7926	283.7634 (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												
	320.7280	283.5419	300.8103	263.2986	254.4741	228.4612	224.7772	234.1134	237.1542	265.4734	283.5671	317.0540 (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	42.6529	38.5252	42.6529	41.2770	42.6529	41.2770	42.6529	42.6529	41.2770	42.6529	41.2770	42.6529 (231)
Lighting	30.8267	24.7303	22.2669	16.3137	12.6012	10.2953	11.4952	14.9419	19.4080	25.4644	28.7620	31.6834 (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	3899.7881 (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	3213.4534 (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)	416.2030 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	502.2030 (231)
Electricity for lighting (calculated in Appendix L)	248.7889 (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	7864.2334 (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	3899.7881	0.2100	818.9555	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3213.4534	0.2100	674.8252	(264)
Space and water heating			1493.7807	(265)
Pumps, fans and electric keep-hot	502.2030	0.1387	69.6618	(267)
Energy for lighting	248.7889	0.1443	35.9079	(268)
Total CO2, kg/year			1599.3504	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.5900	(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	3899.7881	1.1300	4406.7605	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3213.4534	1.1300	3631.2023	(278)
Space and water heating			8037.9629	(279)
Pumps, fans and electric keep-hot	502.2030	1.5128	759.7328	(281)
Energy for lighting	248.7889	1.5338	381.6007	(282)
Total Primary energy kWh/year			9179.2963	(286)

Dwelling Primary energy Rate (DPER) 66.5200 (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	2.5300 (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)
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

	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	0.0200	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	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9132	(42)
Hot water usage for mixer showers	73.0643	71.9663	70.3662	67.3049	65.0457	62.5262	61.0942	62.6821	64.4227	67.1279	70.2550	72.7843	(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)												137.0301	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.0714	145.8880	142.0114	136.1169	131.3300	126.1838	124.2062	128.0661	132.1369	137.5395	143.5249	148.6848	(44)
Energy conte	236.0926	207.7426	218.2663	186.3372	176.7954	155.1577	150.2167	158.5726	162.9380	186.6398	204.4775	232.8045	(45)
Energy content (annual)										Total = Sum(45)m =		2276.0408	
Distribution loss (46)m = 0.15 x (45)m	35.4139	31.1614	32.7399	27.9506	26.5193	23.2737	22.5325	23.7859	24.4407	27.9960	30.6716	34.9207	(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	287.0515	253.7700	269.2252	235.6523	227.7543	204.4728	201.1756	209.5315	212.2530	237.5987	253.7926	283.7634	(62)
WWHRS	-33.4019	-29.5409	-30.9336	-25.6142	-23.8715	-20.4270	-19.1471	-20.3610	-21.1346	-24.9154	-28.2261	-32.7834	(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	253.6496	224.2291	238.2916	210.0380	203.8828	184.0457	182.0285	189.1705	191.1184	212.6833	225.5665	250.9800	(64)
										Total per year (kWh/year) = Sum(64)m =		2565.6840	(64)
12Total per year (kWh/year)												2566	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.2405	80.5813	85.3133	74.2859	71.5242	63.9187	62.6868	65.4651	66.5056	74.7975	80.3175	90.1472	(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	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	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)	-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)	122.6351	119.9126	114.6684	103.1748	96.1347	88.7760	84.2564	87.9907	92.3689	100.5342	111.5521	121.1656	(72)
Total internal gains	654.3692	671.4312	641.5583	618.1310	584.3448	558.8653	535.6309	536.1782	553.7512	576.8502	614.6142	639.3484	(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)
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	905.6809	1116.2760	1294.7533	1502.1253	1642.6328	1639.4731	1564.9788	1430.9129	1286.1513	1080.5074	918.6813	852.4430 (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	0.9495	0.9221	0.8816	0.8060	0.6984	0.5644	0.4470	0.4937	0.6791	0.8496	0.9280	0.9552	(86)
MIT	17.5944	18.0253	18.6509	19.4518	20.1434	20.6283	20.8415	20.7976	20.4052	19.4857	18.3975	17.5164	(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	0.9423	0.9112	0.8646	0.7773	0.6513	0.4908	0.3469	0.3930	0.6126	0.8207	0.9160	0.9488	(89)
MIT 2	15.8651	16.4060	17.1881	18.1743	18.9932	19.5316	19.7339	19.7028	19.3137	18.2413	16.8871	15.7692	(90)
Living area fraction										fLA = Living area / (4) =		0.1300	(91)
MIT	16.0899	16.6165	17.3782	18.3403	19.1427	19.6741	19.8779	19.8451	19.4556	18.4031	17.0835	15.9963	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.0899	16.6165	17.3782	18.3403	19.1427	19.6741	19.8779	19.8451	19.4556	18.4031	17.0835	15.9963	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9074	0.8691	0.8180	0.7330	0.6204	0.4806	0.3520	0.3950	0.5887	0.7752	0.8753	0.9162	(94)
Useful gains	821.8434	970.1477	1059.1270	1101.0478	1019.0681	787.8612	550.8013	565.1732	757.1346	837.6565	804.1670	780.9777	(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	2193.4357	2176.2232	2017.2740	1737.4032	1367.8115	926.3275	598.4086	628.1556	980.2249	1434.0357	1840.0379	2180.6948	(97)
Space heating kWh	1020.4647	810.4827	712.8613	458.1759	259.4651	0.0000	0.0000	0.0000	0.0000	443.7061	745.8270	1041.3895	(98a)
Space heating requirement - total per year (kWh/year)												5492.3724	
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	1020.4647	810.4827	712.8613	458.1759	259.4651	0.0000	0.0000	0.0000	0.0000	443.7061	745.8270	1041.3895	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5492.3724	
Space heating per m2										(98c) / (4) =		39.7998	(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	1020.4647	810.4827	712.8613	458.1759	259.4651	0.0000	0.0000	0.0000	0.0000	443.7061	745.8270	1041.3895	(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)	1104.3990	877.1458	771.4950	495.8614	280.8064	0.0000	0.0000	0.0000	0.0000	480.2015	807.1721	1127.0449	(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	253.6496	224.2291	238.2916	210.0380	203.8828	184.0457	182.0285	189.1705	191.1184	212.6833	225.5665	250.9800	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.0441	86.8835	86.5770	86.0047	84.8991	80.3000	80.3000	80.3000	80.3000	85.9185	86.7428	87.0887	(217)
Fuel for water heating, kWh/month	291.4034	258.0801	275.2366	244.2168	240.1472	229.1977	226.6855	235.5796	238.0055	247.5409	260.0406	288.1890	(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	32.1872	25.8218	23.2497	17.0337	13.1573	10.7496	12.0025	15.6014	20.2646	26.5883	30.0314	33.0818	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-29.3834	-43.4284	-65.3917	-77.1044	-86.2338	-81.5636	-80.5112	-74.4446	-64.3311	-51.1729	-32.9888	-25.1715	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-11.0284	-23.6685	-47.9447	-73.3716	-98.3921	-99.4188	-98.3061	-82.6486	-59.7746	-34.3506	-14.8795	-8.6904 (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	5944.1259 (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	3034.3231 (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)	259.7694 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1364.1991 (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	7960.0193 (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	5944.1259	0.2100	1248.2664	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3034.3231	0.2100	637.2078	(264)
Space and water heating			1885.4743	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	259.7694	0.1443	37.4928	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-711.7253	0.1336	-95.1061	
PV Unit electricity exported	-652.4739	0.1253	-81.7785	
Total			-176.8845	(269)
Total CO2, kg/year			1758.0118	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.7400	(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	5944.1259	1.1300	6716.8623	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3034.3231	1.1300	3428.7851	(278)
Space and water heating			10145.6474	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	259.7694	1.5338	398.4430	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-711.7253	1.4938	-1063.1826	
PV Unit electricity exported	-652.4739	0.4600	-300.1648	
Total			-1363.3474	(283)
Total Primary energy kWh/year			9310.8438	(286)
Target Primary Energy Rate (TPER)			67.4700	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			15.1600	0.9152	13.8748			(27)
Window (Uw = 0.95)			0.9000	0.9152	0.8237			(27)
Door			1.8900	0.8000	1.5120			(26)

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	9.4686	9.3465	9.2243	8.6134	8.4912	7.8802	7.8802	7.7581	8.1246	8.4912	8.7355	8.9799	(38)
Heat transfer coeff	48.9389	48.8167	48.6945	48.0836	47.9614	47.3505	47.3505	47.2283	47.5949	47.9614	48.2058	48.4502	(39)

Average = Sum(39)m / 12 = 48.0531

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9411	0.9388	0.9364	0.9247	0.9223	0.9106	0.9106	0.9082	0.9153	0.9223	0.9270	0.9317	(40)
HLP (average)												0.9241	
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	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)

---

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	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)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.5962	21.6503	21.7046	21.9803	22.0363	22.3207	22.3207	22.3784	22.2061	22.0363	21.9246	21.8141	
alpha	2.4397	2.4434	2.4470	2.4654	2.4691	2.4880	2.4880	2.4919	2.4804	2.4691	2.4616	2.4543	
util living area													
	0.8871	0.8503	0.7931	0.6842	0.5483	0.4065	0.3059	0.3466	0.5315	0.7384	0.8495	0.8953	(86)
MIT	18.7877	19.1253	19.6093	20.2131	20.6420	20.8786	20.9563	20.9397	20.7561	20.1866	19.4094	18.7333	(87)
Th 2	20.1327	20.1347	20.1366	20.1466	20.1486	20.1585	20.1585	20.1605	20.1545	20.1486	20.1446	20.1406	(88)
util rest of house													
	0.8762	0.8365	0.7742	0.6570	0.5116	0.3601	0.2512	0.2888	0.4820	0.7085	0.8334	0.8852	(89)
MIT 2	17.5416	17.9618	18.5607	19.2954	19.7925	20.0558	20.1297	20.1188	19.9350	19.2839	18.3307	17.4786	(90)
Living area fraction									fLA = Living area / (4) =			0.5727	(91)
MIT	18.2553	18.6281	19.1612	19.8209	20.2790	20.5270	20.6031	20.5889	20.4053	19.8008	18.9485	18.1971	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1053	18.4781	19.0112	19.6709	20.1290	20.3770	20.4531	20.4389	20.2553	19.6508	18.7985	18.0471	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8446	0.8049	0.7462	0.6406	0.5107	0.3724	0.2707	0.3083	0.4882	0.6892	0.8032	0.8542	(94)
Useful gains	366.5962	397.6196	409.2130	401.8684	350.8506	256.2446	176.8818	182.9491	258.3887	318.4672	341.5298	355.8147	(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													
	675.6145	662.8378	609.2284	517.9057	404.2671	273.5455	182.4463	190.7517	292.9591	434.0915	563.9333	670.8967	(97)
Space heating kWh													
	229.9096	178.2266	148.8114	83.5469	39.7419	0.0000	0.0000	0.0000	0.0000	86.0245	160.1305	234.4210	(98a)
Space heating requirement - total per year (kWh/year)												1160.8125	
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													
	229.9096	178.2266	148.8114	83.5469	39.7419	0.0000	0.0000	0.0000	0.0000	86.0245	160.1305	234.4210	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1160.8125	
Space heating per m2											(98c) / (4) =	22.3233	(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													
	229.9096	178.2266	148.8114	83.5469	39.7419	0.0000	0.0000	0.0000	0.0000	86.0245	160.1305	234.4210	(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)													
	256.8823	199.1359	166.2698	93.3485	44.4044	0.0000	0.0000	0.0000	0.0000	96.1168	178.9168	261.9230	(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 20.3992 18.4251 20.3992 19.7412 20.3992 19.7412 20.3992 20.3992 19.7412 20.3992 19.7412 20.3992 (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 1296.9973 (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) 154.1846 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 240.1846 (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 4190.6468 (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	1296.9973	0.2100	272.3694	(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			800.9663	(265)
Pumps, fans and electric keep-hot	240.1846	0.1387	33.3166	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			853.9605	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.4200	(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	1296.9973	1.1300	1465.6069	(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			4309.9617	(279)
Pumps, fans and electric keep-hot	240.1846	1.5128	363.3512	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			4882.4308	(286)
Dwelling Primary energy Rate (DPER)			93.8900	(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	2.4500 (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)

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)
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)

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	

---

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													
	77.0119	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)

---

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)

---

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													
	0.9087	0.8828	0.8422	0.7617	0.6496	0.5156	0.4057	0.4505	0.6323	0.8009	0.8819	0.9149	(86)
MIT	17.7667	18.1208	18.6975	19.4864	20.1693	20.6430	20.8460	20.8032	20.4200	19.5473	18.5411	17.7061	(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													
	0.8978	0.8689	0.8230	0.7319	0.6040	0.4483	0.3169	0.3603	0.5688	0.7690	0.8656	0.9046	(89)
MIT 2	16.1396	16.5794	17.2942	18.2572	19.0593	19.5838	19.7784	19.7476	19.3663	18.3562	17.1163	16.0667	(90)
Living area fraction										fLA = Living area / (4) =		0.5727	(91)
MIT	17.0715	17.4622	18.0978	18.9611	19.6949	20.1904	20.3898	20.3521	19.9698	19.0383	17.9323	17.0056	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0715	17.4622	18.0978	18.9611	19.6949	20.1904	20.3898	20.3521	19.9698	19.0383	17.9323	17.0056	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8622	0.8317	0.7868	0.7048	0.5967	0.4684	0.3593	0.4006	0.5752	0.7415	0.8301	0.8700	(94)
Useful gains	370.6677	404.2175	421.1210	428.0072	394.4969	309.5836	225.6172	229.2721	295.5459	335.6763	348.7097	359.4001	(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													
	858.8417	843.1095	776.8869	667.8340	529.7778	367.4847	249.1223	259.4057	387.0456	559.1582	720.2839	854.5753	(97)
Space heating kWh													
	363.2014	294.9355	264.6898	172.6753	100.6490	0.0000	0.0000	0.0000	0.0000	166.2705	267.5335	368.4103	(98a)
Space heating requirement - total per year (kWh/year)												1998.3653	
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													
	363.2014	294.9355	264.6898	172.6753	100.6490	0.0000	0.0000	0.0000	0.0000	166.2705	267.5335	368.4103	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1998.3653	
Space heating per m2											(98c) / (4) =	38.4301	(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													
	363.2014	294.9355	264.6898	172.6753	100.6490	0.0000	0.0000	0.0000	0.0000	166.2705	267.5335	368.4103	(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)													
	393.0751	319.1942	286.4609	186.8780	108.9275	0.0000	0.0000	0.0000	0.0000	179.9465	289.5384	398.7125	(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	85.6480	85.4716	85.1117	84.4536	83.4024	80.3000	80.3000	80.3000	80.3000	84.3406	85.2467	85.6966	(217)
Fuel for water heating, kWh/month													
	232.9132	206.6306	221.1611	197.7009	193.1639	179.7386	177.3695	185.6805	188.8679	200.9310	209.3545	230.4982	(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	-14.0683	-20.9173	-31.6975	-37.6497	-42.3904	-40.2476	-39.7772	-36.6675	-31.4862	-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	-21.6855	-33.2267	-44.5711	-44.9977	-44.4483	-37.3257	-26.9694	-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	2162.7331 (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	2424.0100 (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	-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	4159.3271 (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	2162.7331	0.2100	454.1739	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2424.0100	0.2100	509.0421	(264)
Space and water heating			963.2160	(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	-347.6041	0.1335	-46.3926	
PV Unit electricity exported	-294.9534	0.1253	-36.9657	
Total			-83.3582	(269)
Total CO2, kg/year			910.4262	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.5100	(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	2162.7331	1.1300	2443.8884	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2424.0100	1.1300	2739.1313	(278)
Space and water heating			5183.0197	(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	-347.6041	1.4932	-519.0409	
PV Unit electricity exported	-294.9534	0.4600	-135.6817	
Total			-654.7226	(283)
Total Primary energy kWh/year			4856.4796	(286)
Target Primary Energy Rate (TPER)			93.3900	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000	(1b)	x 2.5200	(2b) =	131.4000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		131.4000	(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		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

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)	9.6000	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	9.7392	9.6135	9.4878	8.8595	8.7338	8.1054	8.1054	7.9797	8.3567	8.7338	8.9851	9.2365	(38)
Heat transfer coeff	62.4673	62.3416	62.2160	61.5876	61.4619	60.8335	60.8335	60.7079	61.0849	61.4619	61.7133	61.9646	(39)

Average = Sum(39)m / 12 = 61.5562

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2013	1.1989	1.1965	1.1844	1.1820	1.1699	1.1699	1.1675	1.1747	1.1820	1.1868	1.1916	(40)
HLP (average)												1.1838	
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	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)

---

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	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	511.7977	615.4696	688.7636	758.7012	795.8913	779.1632	748.3639	707.8376	667.0782	589.0683	516.0163	484.4651	(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	18.3093	18.3462	18.3832	18.5708	18.6088	18.8010	18.8010	18.8399	18.7236	18.6088	18.5330	18.4578	
alpha	2.2206	2.2231	2.2255	2.2381	2.2406	2.2534	2.2534	2.2560	2.2482	2.2406	2.2355	2.2305	
util living area													
	0.8835	0.8356	0.7768	0.6849	0.5717	0.4412	0.3342	0.3637	0.5249	0.7191	0.8415	0.8940	(86)
MIT	18.4031	18.8476	19.3841	20.0025	20.4837	20.7973	20.9219	20.9030	20.6833	20.0456	19.1283	18.3190	(87)
Th 2	19.9190	19.9209	19.9228	19.9325	19.9345	19.9442	19.9442	19.9461	19.9403	19.9345	19.9306	19.9267	(88)
util rest of house													
	0.8703	0.8182	0.7534	0.6523	0.5268	0.3812	0.2612	0.2894	0.4647	0.6822	0.8216	0.8819	(89)
MIT 2	16.9331	17.4809	18.1388	18.8859	19.4415	19.7841	19.8986	19.8865	19.6741	18.9592	17.8469	16.8328	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.8869	18.3677	18.9468	19.6104	20.1178	20.4415	20.5625	20.5460	20.3289	19.6641	18.6783	17.7971	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7369	18.2177	18.7968	19.4604	19.9678	20.2915	20.4125	20.3960	20.1789	19.5141	18.5283	17.6471	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8367	0.7852	0.7254	0.6365	0.5283	0.4016	0.2943	0.3220	0.4789	0.6660	0.7902	0.8489	(94)
Useful gains	428.2329	483.2368	499.6066	482.9080	420.4310	312.9259	220.2477	227.9035	319.4915	392.3216	407.7568	411.2729	(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													
	839.3657	830.2485	765.0560	650.3893	508.1520	346.2361	231.9305	242.5912	371.3308	547.8787	705.2784	833.2427	(97)
Space heating kWh													
	305.8828	233.1918	197.4944	120.5865	65.2644	0.0000	0.0000	0.0000	0.0000	115.7345	214.2156	313.9456	(98a)
Space heating requirement - total per year (kWh/year)												1566.3154	
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													
	305.8828	233.1918	197.4944	120.5865	65.2644	0.0000	0.0000	0.0000	0.0000	115.7345	214.2156	313.9456	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1566.3154	
Space heating per m2											(98c) / (4) =	30.1215	(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													
	305.8828	233.1918	197.4944	120.5865	65.2644	0.0000	0.0000	0.0000	0.0000	115.7345	214.2156	313.9456	(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)													
	341.7685	260.5495	220.6641	134.7335	72.9211	0.0000	0.0000	0.0000	0.0000	129.3123	239.3470	350.7772	(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

(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 19.0897	17.2423	19.0897	18.4739	19.0897	18.4739	19.0897	19.0897	18.4739	19.0897	18.4739	19.0897 (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	1750.0731 (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)	138.7661 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	224.7661 (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	4674.9255 (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	1750.0731	0.2100	367.5154	(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			908.0956	(265)
Pumps, fans and electric keep-hot	224.7661	0.1387	31.1778	(267)
Energy for lighting	125.8946	0.1443	18.1705	(268)
Total CO2, kg/year			957.4439	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.4100	(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	1750.0731	1.1300	1977.5826	(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			4886.4192	(279)
Pumps, fans and electric keep-hot	224.7661	1.5128	340.0262	(281)
Energy for lighting	125.8946	1.5338	193.1013	(282)
Total Primary energy kWh/year			5419.5467	(286)
Dwelling Primary energy Rate (DPER)			104.2200	(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	2.5200 (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)

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)
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)

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	

---

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)

	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													
	77.0589	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	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													
	376.1619	384.0055	367.9208	353.5381	334.4988	317.9623	305.1077	306.7463	317.0195	332.4627	353.8165	368.3595	(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	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)

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	489.1376	578.0027	637.4938	694.4871	722.7202	706.1606	678.2135	644.1592	611.2443	547.9866	489.4191	464.8597	(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	0.9014	0.8654	0.8204	0.7463	0.6475	0.5219	0.4080	0.4392	0.6006	0.7711	0.8685	0.9096	(86)
MIT	17.8250	18.2509	18.8252	19.5430	20.1688	20.6311	20.8426	20.8107	20.4730	19.6576	18.6239	17.7452	(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	0.8888	0.8488	0.7978	0.7131	0.5981	0.4487	0.3115	0.3429	0.5314	0.7338	0.8494	0.8980	(89)
MIT 2	16.1560	16.6807	17.3872	18.2584	18.9899	19.4975	19.6948	19.6725	19.3444	18.4187	17.1591	16.0598	(90)
Living area fraction										fLA = Living area / (4) =		0.6488	(91)
MIT	17.2389	17.6995	18.3203	19.0919	19.7548	20.2330	20.4395	20.4111	20.0767	19.2225	18.1096	17.1533	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2389	17.6995	18.3203	19.0919	19.7548	20.2330	20.4395	20.4111	20.0767	19.2225	18.1096	17.1533	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8550	0.8140	0.7661	0.6922	0.5972	0.4772	0.3655	0.3946	0.5496	0.7144	0.8168	0.8650	(94)
Useful gains	418.2164	470.5064	488.3633	480.6961	431.6423	336.9841	247.8680	254.1644	335.9211	391.4899	399.7737	402.1028	(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	946.0489	934.1571	861.1466	736.2787	580.9719	403.2922	274.8881	286.7725	429.1221	621.9177	796.6364	940.4227	(97)
Space heating kWh	392.7074	311.5733	277.3508	184.0195	111.1013	0.0000	0.0000	0.0000	0.0000	171.4383	285.7411	400.5100	(98a)
Space heating requirement - total per year (kWh/year)												2134.4416	
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	392.7074	311.5733	277.3508	184.0195	111.1013	0.0000	0.0000	0.0000	0.0000	171.4383	285.7411	400.5100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2134.4416	
Space heating per m2											(98c) / (4) =	41.0470	(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	392.7074	311.5733	277.3508	184.0195	111.1013	0.0000	0.0000	0.0000	0.0000	171.4383	285.7411	400.5100	(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)	425.0080	337.2005	300.1632	199.1553	120.2395	0.0000	0.0000	0.0000	0.0000	185.5392	309.2437	433.4524	(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	85.8044	85.5840	85.2104	84.5903	83.6009	80.3000	80.3000	80.3000	80.3000	84.4063	85.3843	85.8627	(217)
Fuel for water heating, kWh/month	232.4887	206.3590	220.9048	197.3813	192.7052	179.7386	177.3695	185.6805	188.8679	200.7748	209.0170	230.0524	(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	16.0113	12.8449	11.5654	8.4733	6.5450	5.3473	5.9706	7.7608	10.0805	13.2262	14.9389	16.4563	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6274	-17.4950	-26.8235	-32.2450	-36.6429	-34.9106	-34.5016	-31.6398	-26.9260	-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	-24.4561	-32.9263	-33.2856	-32.8789	-27.5547	-19.8385	-11.3151	-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												2310.0017	(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	2421.3399 (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)	129.2205 (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	4432.5161 (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	2310.0017	0.2100	485.1004	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2421.3399	0.2100	508.4814	(264)
Space and water heating			993.5817	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	129.2205	0.1443	18.6505	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8254	0.1332	-39.5455	
PV Unit electricity exported	-217.2207	0.1252	-27.1932	
Total			-66.7387	(269)
Total CO2, kg/year			957.4229	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.4100	(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	2310.0017	1.1300	2610.3019	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2421.3399	1.1300	2736.1141	(278)
Space and water heating			5346.4160	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	129.2205	1.5338	198.2027	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-296.8254	1.4923	-442.9557	
PV Unit electricity exported	-217.2207	0.4595	-99.8105	
Total			-542.7661	(283)
Total Primary energy kWh/year			5131.9534	(286)
Target Primary Energy Rate (TPER)			98.6900	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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)

---

2. Ventilation rate

---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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	9.4686	9.3465	9.2243	8.6134	8.4912	7.8802	7.8802	7.7581	8.1246	8.4912	8.7355	8.9799	(38)
Heat transfer coeff	58.6002	58.4780	58.3559	57.7449	57.6228	57.0118	57.0118	56.8897	57.2562	57.6228	57.8671	58.1115	(39)

Average = Sum(39)m / 12 = 57.7144

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1269	1.1246	1.1222	1.1105	1.1081	1.0964	1.0964	1.0940	1.1011	1.1081	1.1128	1.1175	(40)
HLP (average)												1.1099	
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 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)

---
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	19.5317	19.5725	19.6135	19.8210	19.8630	20.0759	20.0759	20.1190	19.9902	19.8630	19.7791	19.6959	
alpha	2.3021	2.3048	2.3076	2.3214	2.3242	2.3384	2.3384	2.3413	2.3327	2.3242	2.3186	2.3131	
util living area													
	0.8990	0.8610	0.8040	0.6998	0.5685	0.4287	0.3254	0.3670	0.5516	0.7546	0.8637	0.9073	(86)
MIT	18.4380	18.8251	19.3697	20.0396	20.5388	20.8310	20.9358	20.9135	20.6829	20.0157	19.1270	18.3699	(87)
Th 2	19.9789	19.9808	19.9827	19.9923	19.9942	20.0038	20.0038	20.0057	20.0000	19.9942	19.9904	19.9865	(88)
util rest of house													
	0.8876	0.8460	0.7830	0.6689	0.5256	0.3726	0.2576	0.2959	0.4933	0.7211	0.8465	0.8968	(89)
MIT 2	17.0086	17.4897	18.1623	18.9740	19.5494	19.8684	19.9653	19.9510	19.7271	18.9706	17.8822	16.9280	(90)
Living area fraction									fLA = Living area / (4) =			0.6206	(91)
MIT	17.8957	18.3184	18.9116	19.6353	20.1634	20.4658	20.5676	20.5483	20.3202	19.6192	18.6547	17.8228	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7457	18.1684	18.7616	19.4853	20.0134	20.3158	20.4176	20.3983	20.1702	19.4692	18.5047	17.6728	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8557	0.8134	0.7538	0.6519	0.5264	0.3907	0.2864	0.3247	0.5038	0.7013	0.8154	0.8657	(94)
Useful gains	392.2809	435.5616	455.9951	454.3583	402.5262	298.8736	208.4141	214.8523	297.4556	356.2136	370.5403	378.6797	(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													
	787.9207	775.9119	715.5346	611.2471	479.0399	325.8661	217.6473	227.4608	347.5589	511.0657	659.9556	782.9249	(97)
Space heating kWh													
	294.3560	228.7153	193.0974	112.9600	56.9262	0.0000	0.0000	0.0000	0.0000	115.2100	208.3790	300.7584	(98a)
Space heating requirement - total per year (kWh/year)												1510.4023	
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													
	294.3560	228.7153	193.0974	112.9600	56.9262	0.0000	0.0000	0.0000	0.0000	115.2100	208.3790	300.7584	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1510.4023	
Space heating per m2											(98c) / (4) =	29.0462	(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													
	294.3560	228.7153	193.0974	112.9600	56.9262	0.0000	0.0000	0.0000	0.0000	115.2100	208.3790	300.7584	(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)													
	328.8894	255.5479	215.7513	126.2123	63.6047	0.0000	0.0000	0.0000	0.0000	128.7262	232.8256	336.0429	(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 20.3992 18.4251 20.3992 19.7412 20.3992 19.7412 20.3992 20.3992 19.7412 20.3992 19.7412 20.3992 (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 1687.6003 (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) 154.1846 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 240.1846 (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 4581.2498 (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	1687.6003	0.2100	354.3961	(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			882.9930	(265)
Pumps, fans and electric keep-hot	240.1846	0.1387	33.3166	(267)
Energy for lighting	136.3368	0.1443	19.6776	(268)
Total CO2, kg/year			935.9872	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.0000	(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	1687.6003	1.1300	1906.9884	(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			4751.3432	(279)
Pumps, fans and electric keep-hot	240.1846	1.5128	363.3512	(281)
Energy for lighting	136.3368	1.5338	209.1179	(282)
Total Primary energy kWh/year			5323.8123	(286)
Dwelling Primary energy Rate (DPER)			102.3800	(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	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)

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)
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)

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	

---

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)

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)

	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	14.5278	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	0.9195	0.8954	0.8591	0.7888	0.6880	0.5607	0.4487	0.4920	0.6663	0.8214	0.8954	0.9253	(86)
MIT	17.4410	17.8078	18.4066	19.2280	19.9757	20.5308	20.7881	20.7372	20.2905	19.3367	18.2610	17.3749	(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	0.9084	0.8811	0.8391	0.7571	0.6376	0.4818	0.3398	0.3832	0.5948	0.7875	0.8787	0.9149	(89)
MIT 2	15.6595	16.1133	16.8529	17.8531	18.7306	19.3422	19.5852	19.5495	19.1106	18.0104	16.6892	15.5796	(90)
Living area fraction										fLA = Living area / (4) =		0.6206	(91)
MIT	16.7650	17.1649	17.8171	18.7064	19.5033	20.0798	20.3317	20.2866	19.8428	18.8335	17.6646	16.6937	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7650	17.1649	17.8171	18.7064	19.5033	20.0798	20.3317	20.2866	19.8428	18.8335	17.6646	16.6937	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8744	0.8447	0.8031	0.7288	0.6295	0.5066	0.3955	0.4353	0.6038	0.7602	0.8442	0.8818	(94)
Useful gains	385.6688	425.2608	445.4936	454.9799	423.9774	339.5803	252.4161	255.3061	321.5317	357.9013	365.6799	372.9115	(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	982.0468	964.6568	888.6490	764.0606	607.1018	423.4362	288.3545	299.9415	444.9293	640.5739	824.3711	977.9045	(97)
Space heating kWh	443.7052	362.4741	329.7076	222.5381	136.2445	0.0000	0.0000	0.0000	0.0000	210.3084	330.2576	450.1148	(98a)
Space heating requirement - total per year (kWh/year)												2485.3504	
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	443.7052	362.4741	329.7076	222.5381	136.2445	0.0000	0.0000	0.0000	0.0000	210.3084	330.2576	450.1148	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2485.3504	
Space heating per m2											(98c) / (4) =	47.7952	(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	443.7052	362.4741	329.7076	222.5381	136.2445	0.0000	0.0000	0.0000	0.0000	210.3084	330.2576	450.1148	(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)	480.2005	392.2880	356.8264	240.8421	147.4508	0.0000	0.0000	0.0000	0.0000	227.6065	357.4217	487.1372	(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	86.0420	85.8865	85.5694	84.9978	84.0244	80.3000	80.3000	80.3000	80.3000	84.8452	85.6808	86.0880	(217)
Fuel for water heating, kWh/month	231.8468	205.6322	219.9780	196.4351	191.7339	179.7386	177.3695	185.6805	188.8679	199.7361	208.2937	229.4504	(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	2689.7732 (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	2414.7629 (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	4677.1135 (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	2689.7732	0.2100	564.8524	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2414.7629	0.2100	507.1002	(264)
Space and water heating			1071.9526	(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			1019.1618	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.6000	(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	2689.7732	1.1300	3039.4437	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2414.7629	1.1300	2728.6821	(278)
Space and water heating			5768.1257	(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			5441.5758	(286)
Target Primary Energy Rate (TPER)			104.6500	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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	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)			19.9200	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

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	0.4430	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	13.4850	13.3110	13.1370	12.2669	12.0929	11.2229	11.2229	11.0488	11.5709	12.0929	12.4409	12.7890	(38)
Heat transfer coeff	75.1048	74.9308	74.7568	73.8867	73.7127	72.8427	72.8427	72.6686	73.1907	73.7127	74.0607	74.4088	(39)
Average = Sum(39)m / 12 =												73.8432	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0431	1.0407	1.0383	1.0262	1.0238	1.0117	1.0117	1.0093	1.0165	1.0238	1.0286	1.0335	(40)
HLP (average)												1.0256	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2937 (42)
Hot water usage for mixer showers

62.6772	61.7353	60.3627	57.7366	55.7986	53.6373	52.4088	53.7710	55.2642	57.5847	60.2673	62.4371	(42a)

Hot water usage for baths

28.5016	28.0783	27.4822	26.3831	25.5602	24.6476	24.1547	24.7466	25.3911	26.3676	27.4892	28.4052	(42b)

Hot water usage for other uses

40.1259	38.6668	37.2077	35.7485	34.2894	32.8303	32.8303	34.2894	35.7485	37.2077	38.6668	40.1259	(42c)

Average daily hot water use (litres/day) 120.6898 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	131.3047	128.4803	125.0526	119.8683	115.6481	111.1152	109.3938	112.8070	116.4038	121.1600	126.4233	130.9682	(44)
Energy conte	207.9545	182.9543	192.2012	164.0937	155.6846	136.6291	132.3024	139.6787	143.5376	164.4129	180.1132	205.0645	(45)
Energy content (annual)											Total = Sum(45)m =	2004.6267	
Distribution loss (46)m = 0.15 x (45)m													
	31.1932	27.4431	28.8302	24.6140	23.3527	20.4944	19.8454	20.9518	21.5306	24.6619	27.0170	30.7597	(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													
	258.9134	228.9817	243.1601	213.4087	206.6435	185.9442	183.2613	190.6376	192.8526	215.3718	229.4283	256.0234	(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													
	258.9134	228.9817	243.1601	213.4087	206.6435	185.9442	183.2613	190.6376	192.8526	215.3718	229.4283	256.0234	(64)
											Total per year (kWh/year) = Sum(64)m =	2604.6267	(64)
12Total per year (kWh/year)												2605	(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													
	81.8846	72.3392	76.6466	66.8899	64.5049	57.7580	56.7303	59.1829	60.0550	67.4070	72.2164	80.9237	(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	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	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)

	-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)

	110.0599	107.6476	103.0196	92.9026	86.7001	80.2194	76.2504	79.5469	83.4097	90.6008	100.3006	108.7684 (72)

Total internal gains

	474.2294	484.8243	464.0044	446.0416	422.2549	402.8331	386.5600	387.7613	400.2990	418.3359	445.6198	464.0287 (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	626.7563	751.8286	848.4416	954.4097	1020.9067	1010.0163	966.5975	898.4769	827.3449	718.5852	629.6220	593.7120 (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	21.4303	21.4801	21.5301	21.7836	21.8351	22.0959	22.0959	22.1488	21.9908	21.8351	21.7325	21.6308	
alpha	2.4287	2.4320	2.4353	2.4522	2.4557	2.4731	2.4731	2.4766	2.4661	2.4557	2.4488	2.4421	
util living area	0.8977	0.8514	0.7897	0.6868	0.5605	0.4222	0.3168	0.3512	0.5245	0.7332	0.8573	0.9077	(86)
MIT	18.6834	19.1012	19.6106	20.1953	20.6174	20.8649	20.9515	20.9363	20.7593	20.1906	19.3500	18.6083	(87)
Th 2	20.0476	20.0496	20.0515	20.0616	20.0636	20.0736	20.0736	20.0756	20.0696	20.0636	20.0596	20.0555	(88)
util rest of house	0.8866	0.8362	0.7687	0.6569	0.5199	0.3698	0.2547	0.2868	0.4701	0.7000	0.8401	0.8975	(89)
MIT 2	17.3524	17.8703	18.4974	19.2055	19.6919	19.9637	20.0437	20.0344	19.8612	19.2206	18.1967	17.2638	(90)
Living area fraction										fLA = Living area / (4) =		0.5421	(91)
MIT	18.0739	18.5376	19.1009	19.7420	20.1936	20.4522	20.5358	20.5233	20.3480	19.7464	18.8218	17.9926	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9239	18.3876	18.9509	19.5920	20.0436	20.3022	20.3858	20.3733	20.1980	19.5964	18.6718	17.8426	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8552	0.8044	0.7410	0.6406	0.5189	0.3831	0.2760	0.3080	0.4780	0.6816	0.8095	0.8670	(94)
Useful gains	536.0045	604.7897	628.6602	611.4268	529.7945	386.9009	266.7922	276.7247	395.4660	489.7715	509.7023	514.7349	(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	1023.2198	1010.6337	930.7884	790.0004	615.0309	415.3669	275.7709	288.7377	446.3190	663.1486	857.0197	1015.1294	(97)
Space heating kWh	362.4881	272.7272	224.7834	128.5730	63.4159	0.0000	0.0000	0.0000	0.0000	128.9926	250.0685	372.2935	(98a)
Space heating requirement - total per year (kWh/year)												1803.3422	
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	362.4881	272.7272	224.7834	128.5730	63.4159	0.0000	0.0000	0.0000	0.0000	128.9926	250.0685	372.2935	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1803.3422	
Space heating per m2											(98c) / (4) =	25.0464	(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	684.7210	539.0357	552.2817	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8622	0.9021	0.8834	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	590.3323	486.2716	487.8787	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1132.9991	1084.5996	1006.1397	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	390.7201	445.1561	385.5862	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	97.6800	111.2890	96.3966	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												305.3656 (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)	4.0300 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	362.4881	272.7272	224.7834	128.5730	63.4159	0.0000	0.0000	0.0000	0.0000	128.9926	250.0685	372.2935	(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)													
	405.0147	304.7231	251.1546	143.6570	70.8557	0.0000	0.0000	0.0000	0.0000	144.1258	279.4062	415.9704	(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													
	258.9134	228.9817	243.1601	213.4087	206.6435	185.9442	183.2613	190.6376	192.8526	215.3718	229.4283	256.0234	(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													
	289.2887	255.8455	271.6872	238.4455	230.8866	207.7589	204.7612	213.0029	215.4778	240.6389	256.3444	286.0597	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	24.2382	27.6151	23.9197	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	23.6227	21.3366	23.6227	22.8606	23.6227	22.8606	23.6227	23.6227	22.8606	23.6227	22.8606	23.6227	(231)
Lighting	18.7599	15.0499	13.5508	9.9279	7.6686	6.2653	6.9955	9.0931	11.8110	15.4966	17.5034	19.2813	(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	2014.9074 (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	2910.1974 (219)
Space cooling fuel	75.7731 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)	
mechanical ventilation fans (SFP = 0.8680)	192.1377 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	278.1377 (231)
Electricity for lighting (calculated in Appendix L)	151.4032 (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	5430.4189 (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	2014.9074	0.2100	423.1306	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2910.1974	0.2100	611.1415	(264)
Space and water heating			1034.2720	(265)

Space cooling	75.7731	0.1142	8.6529 (266)
Pumps, fans and electric keep-hot	278.1377	0.1387	38.5811 (267)
Energy for lighting	151.4032	0.1443	21.8522 (268)
Total CO2, kg/year			1103.3582 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.3200 (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	2014.9074	1.1300	2276.8454	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2910.1974	1.1300	3288.5231	(278)
Space and water heating			5565.3685	(279)
Space cooling	75.7731	1.4209	107.6632	(280)
Pumps, fans and electric keep-hot	278.1377	1.5128	420.7667	(281)
Energy for lighting	151.4032	1.5338	232.2273	(282)
Total Primary energy kWh/year			6326.0257	(286)
Dwelling Primary energy Rate (DPER)			87.8600	(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	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)
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	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2937 (42)

Hot water usage for mixer showers

62.6772	61.7353	60.3627	57.7366	55.7986	53.6373	52.4088	53.7710	55.2642	57.5847	60.2673	62.4371	(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) 117.5446 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.8733	125.1431	121.8181	116.7617	112.6557	108.2413	106.5446	109.8552	113.3469	117.9812	123.1155	127.5416	(44)
Energy conte	202.5201	178.2021	187.2299	159.8409	151.6562	133.0953	128.8565	136.0237	139.7680	160.0994	175.4006	199.6994	(45)
Energy content (annual)										Total = Sum(45)m =		1952.3920	
Distribution loss (46)m = 0.15 x (45)m	30.3780	26.7303	28.0845	23.9761	22.7484	19.9643	19.3285	20.4036	20.9652	24.0149	26.3101	29.9549	(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	253.4790	224.2295	238.1888	209.1560	202.6151	182.4104	179.8154	186.9826	189.0831	211.0583	224.7157	250.6583	(62)
WWHRS	-28.6534	-25.3413	-26.5360	-21.9728	-20.4779	-17.5231	-16.4251	-17.4664	-18.1300	-21.3733	-24.2134	-28.1228	(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	224.8256	198.8882	211.6528	187.1832	182.1372	164.8873	163.3903	169.5162	170.9530	189.6850	200.5023	222.5355	(64)
									Total per year (kWh/year) = Sum(64)m =			2286.1566	(64)
12Total per year (kWh/year)												2286	(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	80.0776	70.7590	74.9937	65.4759	63.1654	56.5830	55.5845	57.9676	58.8016	65.9728	70.6495	79.1398	(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	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	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)

-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)

107.6312	105.2962	100.7979	90.9387	84.8997	78.5875	74.7103	77.9135	81.6689	88.6731	98.1243	106.3706	(72)

Total internal gains

471.8064	482.4792	461.7883	444.0835	420.4602	401.2071	385.0257	386.1336	398.5641	416.4139	443.4493	461.6366	(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	1.1300	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	4.8400	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	608.0955	721.0554	805.2858	898.3007	955.3327	943.6971	903.2642	842.4437	780.1282	684.6931	607.8624	577.5145	(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	0.9155	0.8816	0.8361	0.7561	0.6483	0.5156	0.4015	0.4390	0.6128	0.7908	0.8853	0.9230	(86)
MIT	17.9210	18.3372	18.9125	19.6397	20.2542	20.6842	20.8689	20.8365	20.5119	19.7063	18.6965	17.8474	(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	0.9047	0.8670	0.8155	0.7248	0.6010	0.4463	0.3112	0.3479	0.5468	0.7566	0.8686	0.9131	(89)
MIT 2	16.2960	16.8133	17.5261	18.4142	19.1345	19.6085	19.7818	19.7593	19.4414	18.5186	17.2772	16.2073	(90)
Living area fraction										fLA = Living area / (4) =		0.5421	(91)
MIT	17.1769	17.6394	18.2777	19.0785	19.7414	20.1916	20.3711	20.3432	20.0217	19.1624	18.0466	17.0964	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1769	17.6394	18.2777	19.0785	19.7414	20.1916	20.3711	20.3432	20.0217	19.1624	18.0466	17.0964	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8716	0.8318	0.7819	0.7009	0.5963	0.4677	0.3534	0.3883	0.5573	0.7327	0.8352	0.8812	(94)
Useful gains	530.0404	599.7730	629.6823	629.6585	569.6191	441.3330	319.1749	327.1041	434.7753	501.6966	507.6972	508.9064	(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	1215.9888	1200.5065	1107.6182	948.0512	747.6419	515.4830	347.6514	362.9438	547.7036	796.0815	1021.4818	1208.0242	(97)
Space heating kWh	510.3456	403.6929	355.5843	229.2427	132.4490	0.0000	0.0000	0.0000	0.0000	219.0223	369.9249	520.1436	(98a)
Space heating requirement - total per year (kWh/year)												2740.4054	
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	510.3456	403.6929	355.5843	229.2427	132.4490	0.0000	0.0000	0.0000	0.0000	219.0223	369.9249	520.1436	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2740.4054	
Space heating per m2											(98c) / (4) =	38.0612	(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	510.3456	403.6929	355.5843	229.2427	132.4490	0.0000	0.0000	0.0000	0.0000	219.0223	369.9249	520.1436	(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)	552.3220	436.8971	384.8315	248.0982	143.3430	0.0000	0.0000	0.0000	0.0000	237.0372	400.3517	562.9260	(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

	224.8256	198.8882	211.6528	187.1832	182.1372	164.8873	163.3903	169.5162	170.9530	189.6850	200.5023	222.5355 (64)

Efficiency of water heater 80.3000 (216)

(217)m	86.0807	85.8648	85.4839	84.8169	83.7094	80.3000	80.3000	80.3000	80.3000	84.6904	85.6748	86.1358 (217)

Fuel for water heating, kWh/month

	261.1801	231.6296	247.5937	220.6910	217.5827	205.3392	203.4748	211.1036	212.8930	223.9745	234.0272	258.3541 (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	21.1626	16.9774	15.2863	11.1994	8.6507	7.0677	7.8915	10.2576	13.3237	17.4814	19.7452	21.7507 (232)

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

(233a)m	-15.9484	-23.9141	-36.5343	-43.7446	-49.5390	-47.1124	-46.5385	-42.7497	-36.5007	-28.4907	-18.0335	-13.6267 (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	-5.1360	-11.0930	-22.5977	-34.7646	-46.7875	-47.3131	-46.7575	-39.2119	-28.2501	-16.1303	-6.9412	-4.0404 (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	2965.8067 (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	2727.8434 (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)	170.7941 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-711.7561 (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	5238.6881 (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	2965.8067	0.2100	622.8194	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2727.8434	0.2100	572.8471	(264)
Space and water heating			1195.6665	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.7941	0.1443	24.6509	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-402.7327	0.1333	-53.6895	
PV Unit electricity exported	-309.0234	0.1252	-38.6896	
Total			-92.3791	(269)
Total CO2, kg/year			1139.8675	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.8300	(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	2965.8067	1.1300	3351.3616	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2727.8434	1.1300	3082.4630	(278)
Space and water heating			6433.8246	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.7941	1.5338	261.9696	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-402.7327	1.4926	-601.1307	
PV Unit electricity exported	-309.0234	0.4595	-142.0070	
Total			-743.1377	(283)
Total Primary energy kWh/year			6082.7573	(286)
Target Primary Energy Rate (TPER)			84.4800	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	84.6000 (23c)

Effective ac	0.2252	0.2223	0.2194	0.2049	0.2020	0.1874	0.1874	0.1845	0.1932	0.2020	0.2078	0.2136	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazed Door (Uw = 0.95)			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	9.1788	9.0603	8.9419	8.3497	8.2312	7.6390	7.6390	7.5206	7.8759	8.2312	8.4681	8.7050	(38)
Heat transfer coeff	63.7583	63.6399	63.5214	62.9292	62.8108	62.2185	62.2185	62.1001	62.4554	62.8108	63.0476	63.2845	(39)
Average = Sum(39)m / 12 =												62.8996	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2752	1.2728	1.2704	1.2586	1.2562	1.2444	1.2444	1.2420	1.2491	1.2562	1.2610	1.2657	(40)
HLP (average)												1.2580	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.6901 (42)

Hot water usage for mixer showers

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

Hot water usage for baths

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

Hot water usage for other uses

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
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	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(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	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(64)
										Total per year (kWh/year) = Sum(64)m =		2216.1948	(64)
12Total per year (kWh/year)												2216	(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	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(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	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)

93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557 (72)

Total internal gains

365.8608	373.3878	357.8095	343.4627	324.9879	308.8126	296.3460	297.9790	307.9545	323.2136	344.1443	358.3074 (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	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	442.8211	524.5256	617.8484	754.9113	867.3058	883.0408	835.0516	733.5721	619.5618	504.6095	439.9755	421.8072 (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	15.4754	15.5042	15.5331	15.6793	15.7089	15.8584	15.8584	15.8886	15.7982	15.7089	15.6498	15.5913	
alpha	2.0317	2.0336	2.0355	2.0453	2.0473	2.0572	2.0572	2.0592	2.0532	2.0473	2.0433	2.0394	
util living area	0.8944	0.8561	0.7921	0.6745	0.5337	0.3982	0.3049	0.3533	0.5456	0.7537	0.8611	0.9026	(86)
MIT	17.8626	18.2970	18.9709	19.8086	20.4266	20.7788	20.9088	20.8740	20.5594	19.7098	18.6525	17.7858	(87)
Th 2	19.8603	19.8622	19.8641	19.8734	19.8753	19.8847	19.8847	19.8865	19.8809	19.8753	19.8715	19.8678	(88)
util rest of house	0.8823	0.8402	0.7696	0.6413	0.4885	0.3402	0.2344	0.2779	0.4834	0.7187	0.8431	0.8914	(89)
MIT 2	16.2716	16.8069	17.6311	18.6323	19.3347	19.7127	19.8323	19.8098	19.5093	18.5517	17.2635	16.1789	(90)
Living area fraction										fLA = Living area / (4) =		0.6400	(91)
MIT	17.2898	17.7606	18.4885	19.3851	20.0335	20.3950	20.5213	20.4909	20.1813	19.2929	18.1525	17.2073	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.1398	17.6106	18.3385	19.2351	19.8835	20.2450	20.3713	20.3409	20.0313	19.1429	18.0025	17.0573	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8441	0.8008	0.7338	0.6205	0.4889	0.3595	0.2658	0.3096	0.4923	0.6922	0.8053	0.8541	(94)
Useful gains	373.7686	420.0302	453.3839	468.3991	423.9833	317.4651	221.9964	227.1092	305.0261	349.3119	354.3012	360.2546	(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	818.6449	808.8980	752.0011	650.3792	514.0142	351.2240	234.6450	244.7306	370.4443	536.5874	687.3745	813.6695	(97)
Space heating kWh	330.9880	261.3191	222.1712	131.0256	66.9830	0.0000	0.0000	0.0000	0.0000	139.3330	239.8128	337.3407	(98a)
Space heating requirement - total per year (kWh/year)												1728.9733	
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	330.9880	261.3191	222.1712	131.0256	66.9830	0.0000	0.0000	0.0000	0.0000	139.3330	239.8128	337.3407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1728.9733	
Space heating per m2											(98c) / (4) =	34.5795	(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	330.9880	261.3191	222.1712	131.0256	66.9830	0.0000	0.0000	0.0000	0.0000	139.3330	239.8128	337.3407	(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)	369.8190	291.9767	248.2360	146.3974	74.8413	0.0000	0.0000	0.0000	0.0000	155.6793	267.9472	376.9170	(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

	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034 (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												
	246.6689	218.3773	232.3458	203.6942	195.8646	174.7015	171.5864	179.8809	183.3094	206.3149	219.4253	244.0262 (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	19.9984	18.0630	19.9984	19.3533	19.9984	19.3533	19.9984	19.9984	19.3533	19.9984	19.3533	19.9984 (231)
Lighting	16.5676	13.2912	11.9672	8.7677	6.7724	5.5331	6.1780	8.0304	10.4307	13.6857	15.4580	17.0281 (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	1931.8138 (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	2476.1953 (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)	149.4646 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	235.4646 (231)
Electricity for lighting (calculated in Appendix L)	133.7101 (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	4777.1838 (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	1931.8138	0.2100	405.6809	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2476.1953	0.2100	520.0010	(264)
Space and water heating			925.6819	(265)
Pumps, fans and electric keep-hot	235.4646	0.1387	32.6618	(267)
Energy for lighting	133.7101	0.1443	19.2985	(268)
Total CO2, kg/year			977.6423	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			19.5500	(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	1931.8138	1.1300	2182.9496	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2476.1953	1.1300	2798.1007	(278)
Space and water heating			4981.0503	(279)
Pumps, fans and electric keep-hot	235.4646	1.5128	356.2109	(281)
Energy for lighting	133.7101	1.5338	205.0890	(282)
Total Primary energy kWh/year			5542.3502	(286)
Dwelling Primary energy Rate (DPER)			110.8500	(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	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)
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	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
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	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
									Total per year (kWh/year) = Sum(64)m =			1992.9475	(64)
12Total per year (kWh/year)												1993	(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	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	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	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)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.0132	373.5565	357.9619	343.6202	325.1403	308.9701	296.4984	298.1314	308.1120	323.3660	344.3017	358.4598	(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	4.7000	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	409.0698	458.0994	503.3907	573.6848	628.3520	630.0120	597.6845	541.6853	482.3669	424.8262	397.9135	393.9873	(84)

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	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	0.9155	0.8946	0.8606	0.7908	0.6901	0.5647	0.4568	0.5038	0.6786	0.8261	0.8932	0.9206	(86)

MIT	17.1313	17.4805	18.1049	18.9935	19.8206	20.4433	20.7380	20.6745	20.1559	19.1138	17.9898	17.0695 (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												
	0.9043	0.8806	0.8412	0.7600	0.6405	0.4863	0.3466	0.3939	0.6085	0.7935	0.8767	0.9101 (89)
MIT 2	15.3209	15.7500	16.5165	17.5925	18.5603	19.2475	19.5302	19.4847	18.9692	17.7645	16.3901	15.2465 (90)
Living area fraction										fLA = Living area / (4) =		0.6400 (91)
MIT	16.4795	16.8575	17.5330	18.4892	19.3669	20.0128	20.3032	20.2462	19.7287	18.6280	17.4139	16.4132 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4795	16.8575	17.5330	18.4892	19.3669	20.0128	20.3032	20.2462	19.7287	18.6280	17.4139	16.4132 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8670	0.8411	0.8014	0.7272	0.6280	0.5080	0.4019	0.4447	0.6121	0.7617	0.8388	0.8737	(94)
Useful gains	354.6628	385.3078	403.4116	417.1837	394.5769	320.0772	240.2343	240.8824	295.2714	323.6054	333.7810	344.2377	(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													
	944.5634	925.7757	852.7850	735.3952	587.1081	411.6532	281.6335	292.1348	429.2106	614.7637	792.1645	940.9605	(97)
Space heating kWh													
	438.8860	363.1944	334.3338	229.1123	143.2432	0.0000	0.0000	0.0000	0.0000	216.6218	330.0361	443.9617	(98a)
Space heating requirement - total per year (kWh/year)												2499.3894	
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													
	438.8860	363.1944	334.3338	229.1123	143.2432	0.0000	0.0000	0.0000	0.0000	216.6218	330.0361	443.9617	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2499.3894	
Space heating per m2											(98c) / (4) =	49.9878	(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													
	438.8860	363.1944	334.3338	229.1123	143.2432	0.0000	0.0000	0.0000	0.0000	216.6218	330.0361	443.9617	(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)													
	474.9849	393.0676	361.8331	247.9570	155.0251	0.0000	0.0000	0.0000	0.0000	234.4392	357.1819	480.4780	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0476	85.9173	85.6254	85.0994	84.1701	80.3000	80.3000	80.3000	80.3000	84.9433	85.7066	86.0880	(217)
Fuel for water heating, kWh/month													
	228.6431	202.7511	216.8729	192.5765	187.8664	176.4186	174.0932	182.2506	185.3789	196.2833	205.4475	226.3050	(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	15.4620	12.4042	11.1686	8.1826	6.3205	5.1639	5.7657	7.4945	9.7346	12.7724	14.4264	15.8917	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.1922	-16.8466	-25.8401	-31.0772	-35.3304	-33.6675	-33.2751	-30.5091	-25.9536	-20.1440	-12.6830	-9.5570	(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	-3.4498	-7.4638	-15.2238	-23.4431	-31.5631	-31.9058	-31.5138	-26.4087	-19.0122	-10.8428	-4.6606	-2.7118	(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												2704.9669	(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												2374.8870	(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)	124.7869 (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	4796.3657 (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	2704.9669	0.2100	568.0430	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2374.8870	0.2100	498.7263	(264)
Space and water heating			1066.7693	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	124.7869	0.1443	18.0106	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0757	0.1332	-38.1105	
PV Unit electricity exported	-208.1994	0.1252	-26.0637	
Total			-64.1742	(269)
Total CO2, kg/year			1032.5350	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.6500	(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	2704.9669	1.1300	3056.6126	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2374.8870	1.1300	2683.6223	(278)
Space and water heating			5740.2348	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	124.7869	1.5338	191.4023	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.0757	1.4923	-426.9031	
PV Unit electricity exported	-208.1994	0.4595	-95.6648	
Total			-522.5679	(283)
Total Primary energy kWh/year			5539.1701	(286)
Target Primary Energy Rate (TPER)			110.7800	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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	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) =	83.7000 (23c)

Effective ac	0.5756	0.5659	0.5562	0.5078	0.4981	0.4496	0.4496	0.4399	0.4690	0.4981	0.5174	0.5368	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

	m2	m2	m2	W/m2K	W/K	kJ/m2K	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	81.2457	79.8782	78.5108	71.6734	70.3059	63.4685	63.4685	62.1011	66.2035	70.3059	73.0409	75.7758	(38)
Heat transfer coeff	320.8388	319.4713	318.1039	311.2665	309.8990	303.0616	303.0616	301.6942	305.7966	309.8990	312.6340	315.3689	(39)
Average = Sum(39)m / 12 =												310.9246	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.1227	2.1136	2.1046	2.0593	2.0503	2.0050	2.0050	1.9960	2.0231	2.0503	2.0684	2.0865	(40)
HLP (average)												2.0571	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9360	(42)

Hot water usage for mixer showers

73.4464	72.3426	70.7342	67.6569	65.3859	62.8532	61.4137	63.0099	64.7597	67.4789	70.6224	73.1650	(42a)

Hot water usage for baths

33.3764	32.8807	32.1827	30.8956	29.9319	28.8633	28.2861	28.9792	29.7339	30.8774	32.1909	33.2636	(42b)

Hot water usage for other uses

47.0497	45.3388	43.6279	41.9170	40.2061	38.4952	38.4952	40.2061	41.9170	43.6279	45.3388	47.0497	(42c)

Average daily hot water use (litres/day)	141.4328	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	153.8725	150.5622	146.5448	140.4695	135.5239	130.2118	128.1950	132.1953	136.4106	141.9843	148.1522	153.4783	(44)
Energy conte	243.6964	214.3985	225.2340	192.2958	182.4412	160.1106	155.0408	163.6854	168.2080	192.6713	211.0699	240.3099	(45)
Energy content (annual)										Total = Sum(45)m =		2349.1618	
Distribution loss (46)m = 0.15 x (45)m	36.5545	32.1598	33.7851	28.8444	27.3662	24.0166	23.2561	24.5528	25.2312	28.9007	31.6605	36.0465	(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	294.6553	260.4259	276.1929	241.6109	233.4001	209.4256	205.9997	214.6443	217.5230	243.6302	260.3850	291.2688	(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	294.6553	260.4259	276.1929	241.6109	233.4001	209.4256	205.9997	214.6443	217.5230	243.6302	260.3850	291.2688	(64)
										Total per year (kWh/year) = Sum(64)m =		2949.1618	(64)
12Total per year (kWh/year)												2949	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	93.7688	82.7944	87.6300	76.2671	73.4014	65.5655	64.2908	67.1651	68.2579	76.8029	82.5095	92.6428	(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	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	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)	-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)	126.0333	123.2059	117.7823	105.9265	98.6578	91.0632	86.4123	90.2757	94.8027	103.2298	114.5966	124.5198	(72)
Total internal gains	680.2550	698.1678	666.9289	642.5742	607.2803	580.8478	556.5858	557.1102	575.4650	599.3910	638.7830	664.5442	(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	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)

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	908.9004	1107.5640	1280.0162	1490.9440	1638.5092	1640.2415	1563.1301	1421.7874	1269.1731	1066.1333	916.2767	857.8686 (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	32.7159	32.8559	32.9972	33.7220	33.8708	34.6350	34.6350	34.7919	34.3252	33.8708	33.5745	33.2833	
alpha	3.1811	3.1904	3.1998	3.2481	3.2581	3.3090	3.3090	3.3195	3.2883	3.2581	3.2383	3.2189	
util living area	0.9971	0.9941	0.9880	0.9696	0.9247	0.8277	0.7036	0.7591	0.9156	0.9816	0.9949	0.9976	(86)
MIT	18.3179	18.5611	18.9773	19.5880	20.1671	20.6429	20.8567	20.8104	20.4199	19.6739	18.9136	18.3085	(87)
Th 2	19.2528	19.2587	19.2645	19.2941	19.3000	19.3300	19.3300	19.3360	19.3180	19.3000	19.2881	19.2763	(88)
util rest of house	0.9959	0.9918	0.9828	0.9548	0.8814	0.7138	0.4968	0.5669	0.8459	0.9700	0.9925	0.9967	(89)
MIT 2	16.9078	17.1539	17.5714	18.1917	18.7449	19.1688	19.2989	19.2870	18.9985	18.2874	17.5255	16.9137	(90)
Living area fraction									fLA = Living area / (4) =			0.0864	(91)
MIT	17.0297	17.2755	17.6929	18.3124	18.8678	19.2961	19.4335	19.4186	19.1213	18.4072	17.6455	17.0342	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0297	17.2755	17.6929	18.3124	18.8678	19.2961	19.4335	19.4186	19.1213	18.4072	17.6455	17.0342	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9875	0.9754	0.9420	0.8660	0.7108	0.5125	0.5791	0.8339	0.9600	0.9885	0.9946	(94)
Useful gains	902.9563	1093.7401	1248.5371	1404.4294	1418.8967	1165.8632	801.0312	823.3250	1058.3791	1023.5341	905.7622	853.2786	(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	4084.1712	3953.6114	3560.5027	2929.7507	2221.2945	1423.2223	858.7129	910.7031	1535.4992	2419.4394	3296.8672	4047.5091	(97)
Space heating kWh	2366.8239	1921.8335	1720.1024	1098.2313	596.9840	0.0000	0.0000	0.0000	0.0000	1038.5535	1721.5956	2376.5075	(98a)
Space heating requirement - total per year (kWh/year)												12840.6317	
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	2366.8239	1921.8335	1720.1024	1098.2313	596.9840	0.0000	0.0000	0.0000	0.0000	1038.5535	1721.5956	2376.5075	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12840.6317	
Space heating per m2										(98c) / (4) =		84.9529	(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	2848.7794	2242.6561	2292.8756	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5814	0.6652	0.6130	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1656.2775	1491.8627	1405.4273	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1835.8282	1749.1625	1586.0351	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	129.2765	191.4311	134.3722	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.9990	(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	32.2870	47.8103	33.5597	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												113.6570	(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													
	2366.8239	1921.8335	1720.1024	1098.2313	596.9840	0.0000	0.0000	0.0000	0.0000	1038.5535	1721.5956	2376.5075	(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)													
	2804.2937	2277.0539	2038.0360	1301.2219	707.3270	0.0000	0.0000	0.0000	0.0000	1230.5136	2039.8053	2815.7672	(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													
	294.6553	260.4259	276.1929	241.6109	233.4001	209.4256	205.9997	214.6443	217.5230	243.6302	260.3850	291.2688	(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													
	329.5921	291.3042	308.9406	270.2582	261.0740	234.2569	230.4247	240.0943	243.3144	272.5170	291.2584	325.8040	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	7.5086	11.1187	7.8046	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	54.0199	48.7921	54.0199	52.2773	54.0199	52.2773	54.0199	54.0199	52.2773	54.0199	52.2773	54.0199	(231)
Lighting	29.8373	23.9366	21.5523	15.7901	12.1967	9.9648	11.1263	14.4623	18.7852	24.6471	27.8389	30.6666	(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 15214.0186 (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 3298.8387 (219)
Space cooling fuel 26.4319 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 550.0403 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 636.0403 (231)
Electricity for lighting (calculated in Appendix L) 240.8043 (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 19416.1337 (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	15214.0186	0.2100	3194.9439	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3298.8387	0.2100	692.7561	(264)
Space and water heating			3887.7000	(265)
Space cooling	26.4319	0.1139	3.0093	(266)
Pumps, fans and electric keep-hot	636.0403	0.1387	88.2266	(267)
Energy for lighting	240.8043	0.1443	34.7555	(268)
Total CO2, kg/year			4013.6915	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			26.5500	(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	15214.0186	1.1300	17191.8410	(275)

Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3298.8387	1.1300	3727.6877 (278)
Space and water heating			20919.5287 (279)
Space cooling	26.4319	1.4197	37.5251 (280)
Pumps, fans and electric keep-hot	636.0403	1.5128	962.2018 (281)
Energy for lighting	240.8043	1.5338	369.3536 (282)
Total Primary energy kWh/year			22288.6092 (286)
Dwelling Primary energy Rate (DPER)			147.4600 (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)	
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)
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	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9360 (42)
Hot water usage for mixer showers	73.4464	72.3426	70.7342	67.6569	65.3859	62.8532	61.4137	63.0099	64.7597	67.4789	70.6224	73.1650 (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)												137.7469 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.8512	146.6512	142.7543	136.8289	132.0170	126.8438	124.8560	128.7360	132.8281	138.2590	144.2757	149.4626	(44)
Energy conte	237.3277	208.8293	219.4081	187.3119	177.7203	155.9693	151.0025	159.4021	163.7903	187.6162	205.5472	234.0223	(45)
Energy content (annual)										Total = Sum(45)m =		2287.9471	
Distribution loss (46)m = 0.15 x (45)m	35.5992	31.3244	32.9112	28.0968	26.6580	23.3954	22.6504	23.9103	24.5685	28.1424	30.8321	35.1033	(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	288.2866	254.8567	270.3670	236.6270	228.6792	205.2844	201.9614	210.3610	213.1054	238.5751	254.8622	284.9812	(62)
WWHRS	-33.5766	-29.6954	-31.0953	-25.7482	-23.9964	-20.5339	-19.2472	-20.4675	-21.2451	-25.0457	-28.3737	-32.9548	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	254.7100	225.1613	239.2716	210.8788	204.6828	184.7505	182.7141	189.8935	191.8603	213.5294	226.4885	252.0264	(64)
										Total per year (kWh/year) = Sum(64)m =		2575.9672	(64)
12Total per year (kWh/year)												2576	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.6512	80.9426	85.6929	74.6100	71.8317	64.1886	62.9480	65.7409	66.7891	75.1221	80.6732	90.5521	(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	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	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)	-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)	123.1871	120.4503	115.1786	103.6250	96.5480	89.1508	84.6076	88.3614	92.7626	100.9706	112.0461	121.7099	(72)
Total internal gains	677.4088	695.4122	664.3252	640.2726	605.1705	578.9354	554.7811	555.1960	573.4249	597.1318	636.2325	661.7342	(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	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	909.7420	1111.4116	1287.3011	1502.3259	1653.0320	1655.4160	1577.5599	1433.8196	1278.3218	1071.4022	918.2019	858.1768	(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	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	0.9979	0.9945	0.9854	0.9516	0.8609	0.6943	0.5328	0.6004	0.8448	0.9746	0.9954	0.9984	(86)
MIT	19.3214	19.5427	19.8779	20.3297	20.7098	20.9229	20.9817	20.9692	20.8048	20.2984	19.7261	19.2842	(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	0.9972	0.9926	0.9800	0.9330	0.8088	0.5940	0.4005	0.4638	0.7669	0.9613	0.9935	0.9978	(89)
MIT 2	17.8735	18.1574	18.5843	19.1504	19.5877	19.7947	19.8324	19.8286	19.7003	19.1235	18.3981	17.8303	(90)
Living area fraction										fLA = Living area / (4) =		0.0864	(91)
MIT	17.9986	18.2771	18.6961	19.2523	19.6847	19.8922	19.9317	19.9272	19.7958	19.2250	18.5129	17.9559	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9986	18.2771	18.6961	19.2523	19.6847	19.8922	19.9317	19.9272	19.7958	19.2250	18.5129	17.9559	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9887	0.9726	0.9209	0.8011	0.5991	0.4116	0.4748	0.7637	0.9514	0.9900	0.9964	(94)
Useful gains	905.4717	1098.8440	1251.9752	1383.4391	1324.2459	991.8293	649.3956	680.8378	976.2602	1019.3649	908.9816	855.0454	(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	2748.9981	2680.2400	2439.8372	2055.9328	1583.5663	1042.8719	656.5442	694.2323	1125.1793	1710.5568	2269.7482	2743.6278	(97)
Space heating kWh	1371.5837	1062.6981	883.7693	484.1954	192.9344	0.0000	0.0000	0.0000	0.0000	514.2467	979.7520	1405.1053	(98a)
Space heating requirement - total per year (kWh/year)												6894.2850	
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	1371.5837	1062.6981	883.7693	484.1954	192.9344	0.0000	0.0000	0.0000	0.0000	514.2467	979.7520	1405.1053	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6894.2850	
Space heating per m2											(98c) / (4) =	45.6122	(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	1371.5837	1062.6981	883.7693	484.1954	192.9344	0.0000	0.0000	0.0000	0.0000	514.2467	979.7520	1405.1053	(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		(210)
Space heating fuel (main heating system)	1484.3979	1150.1061	956.4603	524.0210	208.8035	0.0000	0.0000	0.0000	0.0000	556.5441	1060.3377	1520.6768	(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	254.7100	225.1613	239.2716	210.8788	204.6828	184.7505	182.7141	189.8935	191.8603	213.5294	226.4885	252.0264	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4334	87.2660	86.9167	86.1023	84.2549	80.3000	80.3000	80.3000	80.3000	86.1916	87.1475	87.4752	(217)
Fuel for water heating, kWh/month	291.3188	258.0172	275.2883	244.9166	242.9328	230.0754	227.5394	236.4801	238.9293	247.7380	259.8909	288.1119	(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	33.7459	27.0722	24.3755	17.8586	13.7945	11.2702	12.5838	16.3569	21.2459	27.8758	31.4857	34.6838	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-50.2312	-71.1561	-102.7378	-115.9942	-125.3966	-117.0489	-115.4873	-108.8025	-97.1640	-81.4597	-55.2984	-43.3785	(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	-27.3713	-57.6893	-114.9009	-172.9634	-229.1387	-230.4897	-227.8937	-192.8618	-141.1550	-82.7701	-36.6225	-21.6461	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	7461.3474 (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	3041.2386 (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)	272.3487 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2619.6578 (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	8241.2769 (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	7461.3474	0.2100	1566.8830	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3041.2386	0.2100	638.6601	(264)
Space and water heating			2205.5431	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	272.3487	0.1443	39.3083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1084.1552	0.1345	-145.8352	
PV Unit electricity exported	-1535.5026	0.1258	-193.1928	
Total			-339.0280	(269)
Total CO2, kg/year			1917.7527	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	7461.3474	1.1300	8431.3226	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3041.2386	1.1300	3436.5996	(278)
Space and water heating			11867.9222	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	272.3487	1.5338	417.7376	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1084.1552	1.4971	-1623.1334	
PV Unit electricity exported	-1535.5026	0.4618	-709.1431	
Total			-2332.2765	(283)
Total Primary energy kWh/year			10083.4841	(286)
Target Primary Energy Rate (TPER)			66.7100	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

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	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) =	83.7000	(23c)

Effective ac	0.5756	0.5659	0.5562	0.5078	0.4981	0.4496	0.4496	0.4399	0.4690	0.4981	0.5174	0.5368	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

Windows (Uw = 1.50)			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	59.8754	58.8676	57.8598	52.8209	51.8131	46.7742	46.7742	45.7664	48.7898	51.8131	53.8287	55.8442	(38)
Heat transfer coeff	171.1038	170.0960	169.0883	164.0493	163.0416	158.0026	158.0026	156.9948	160.0182	163.0416	165.0571	167.0727	(39)
Average = Sum(39)m / 12 =												163.7974	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6541	1.6444	1.6347	1.5859	1.5762	1.5275	1.5275	1.5177	1.5470	1.5762	1.5957	1.6152	(40)
HLP (average)												1.5835	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7692 (42)
Hot water usage for mixer showers	70.6497	69.5880	68.0408	65.0806	62.8961	60.4599	59.0752	60.6106	62.2937	64.9095	67.9332	70.3790 (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)												132.5005 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.1436	141.0656	137.3173	131.6175	126.9890	122.0129	120.1006	123.8328	127.7689	132.9929	138.7805	143.7698	(44)
Energy conte	228.2883	200.8756	211.0515	180.1778	170.9515	150.0290	145.2512	153.3308	157.5518	180.4702	197.7182	225.1088	(45)
Energy content (annual)										Total = Sum(45)m =		2200.8050	
Distribution loss (46)m = 0.15 x (45)m	34.2432	30.1313	31.6577	27.0267	25.6427	22.5044	21.7877	22.9996	23.6328	27.0705	29.6577	33.7663	(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	279.2472	246.9030	262.0104	229.4929	221.9104	199.3441	196.2101	204.2897	206.8669	231.4291	247.0333	276.0677	(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	279.2472	246.9030	262.0104	229.4929	221.9104	199.3441	196.2101	204.2897	206.8669	231.4291	247.0333	276.0677	(64)
									Total per year (kWh/year) = Sum(64)m =			2800.8050	(64)
12Total per year (kWh/year)												2801	(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	88.6456	78.2980	82.9144	72.2379	69.5811	62.2134	61.0358	63.7222	64.7148	72.7461	78.0701	87.5884	(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	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	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)	-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)	119.1473	116.5149	111.4440	100.3304	93.5230	86.4075	82.0373	85.6482	89.8816	97.7770	108.4307	117.7264	(72)
Total internal gains	581.0176	595.3045	569.1856	547.9180	518.2967	495.3110	474.9720	475.8665	491.3638	512.4130	545.8807	568.0466	(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	701.7280	814.5008	907.3170	1034.4365	1127.4334	1128.9563	1073.7914	978.3394	879.8786	764.7692	692.8854	669.8108	(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	41.9823	42.2310	42.4827	43.7876	44.0583	45.4634	45.4634	45.7552	44.8907	44.0583	43.5203	42.9953	
alpha	3.7988	3.8154	3.8322	3.9192	3.9372	4.0309	4.0309	4.0503	3.9927	3.9372	3.9014	3.8664	
util living area	0.9964	0.9931	0.9859	0.9612	0.8961	0.7548	0.6029	0.6661	0.8790	0.9756	0.9934	0.9970	(86)
MIT	18.9515	19.1654	19.5171	20.0488	20.5134	20.8458	20.9536	20.9315	20.6804	20.0869	19.4607	18.9564	(87)
Th 2	19.5739	19.5809	19.5880	19.6237	19.6308	19.6670	19.6670	19.6742	19.6525	19.6308	19.6165	19.6022	(88)
util rest of house	0.9950	0.9906	0.9804	0.9445	0.8481	0.6464	0.4411	0.5063	0.8036	0.9621	0.9906	0.9959	(89)
MIT 2	17.7561	17.9739	18.3277	18.8727	19.3069	19.5983	19.6563	19.6560	19.4771	18.9224	18.2942	17.7811	(90)
Living area fraction										fLA = Living area / (4) =		0.1322	(91)
MIT	17.9140	18.1314	18.4849	19.0281	19.4664	19.7631	19.8278	19.8246	19.6361	19.0763	18.4483	17.9364	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9140	18.1314	18.4849	19.0281	19.4664	19.7631	19.8278	19.8246	19.6361	19.0763	18.4483	17.9364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9867	0.9741	0.9347	0.8409	0.6554	0.4622	0.5265	0.8024	0.9541	0.9869	0.9939	(94)
Useful gains	696.5712	803.6641	883.7902	966.9281	948.1026	739.9044	496.3572	515.1157	706.0300	729.6339	683.7992	665.7433	(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	2329.4138	2250.6055	2026.5013	1661.5151	1266.2397	815.7886	509.9949	537.6439	885.8814	1381.9916	1873.1217	2294.9793	(97)
Space heating kWh	1214.8349	972.3446	850.1771	500.1027	236.6940	0.0000	0.0000	0.0000	0.0000	485.3542	856.3122	1212.1516	(98a)
Space heating requirement - total per year (kWh/year)												6327.9712	
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	1214.8349	972.3446	850.1771	500.1027	236.6940	0.0000	0.0000	0.0000	0.0000	485.3542	856.3122	1212.1516	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6327.9712	
Space heating per m2											(98c) / (4) =	61.1753	(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	1485.2247	1169.2195	1193.1609	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7239	0.8052	0.7574	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1075.1194	941.4563	903.7208	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1241.6893	1180.9311	1073.2649	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	119.9303	178.1692	126.1408	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	0.9957	(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	29.8550	44.3528	31.4011	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												105.6090	(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													
	1214.8349	972.3446	850.1771	500.1027	236.6940	0.0000	0.0000	0.0000	0.0000	485.3542	856.3122	1212.1516	(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)													
	1439.3778	1152.0671	1007.3188	592.5387	280.4431	0.0000	0.0000	0.0000	0.0000	575.0642	1014.5879	1436.1986	(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													
	279.2472	246.9030	262.0104	229.4929	221.9104	199.3441	196.2101	204.2897	206.8669	231.4291	247.0333	276.0677	(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													
	312.3570	276.1778	293.0766	256.7035	248.2220	222.9800	219.4744	228.5120	231.3948	258.8692	276.3236	308.8006	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	6.9430	10.3146	7.3026	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	41.7321	37.6935	41.7321	40.3859	41.7321	40.3859	41.7321	41.7321	40.3859	41.7321	40.3859	41.7321	(231)
Lighting	24.3533	19.5371	17.5910	12.8879	9.9550	8.1333	9.0813	11.8042	15.3325	20.1171	22.7222	25.0302	(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 7497.5962 (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 3132.8915 (219)
Space cooling fuel 24.5602 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)
mechanical ventilation fans (SFP = 1.0540) 405.3613 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 491.3613 (231)
Electricity for lighting (calculated in Appendix L) 196.5451 (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 11342.9543 (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	7497.5962	0.2100	1574.4952	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3132.8915	0.2100	657.9072	(264)
Space and water heating			2232.4024	(265)
Space cooling	24.5602	0.1138	2.7960	(266)
Pumps, fans and electric keep-hot	491.3613	0.1387	68.1579	(267)
Energy for lighting	196.5451	0.1443	28.3675	(268)
Total CO2, kg/year			2331.7238	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			22.5400	(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	7497.5962	1.1300	8472.2837 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3132.8915	1.1300	3540.1674 (278)
Space and water heating			12012.4511 (279)
Space cooling	24.5602	1.4197	34.8671 (280)
Pumps, fans and electric keep-hot	491.3613	1.5128	743.3314 (281)
Energy for lighting	196.5451	1.5338	301.4675 (282)
Total Primary energy kWh/year			13092.1170 (286)
Dwelling Primary energy Rate (DPER)			126.5700 (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	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)
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	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7692 (42)

Hot water usage for mixer showers

70.6497	69.5880	68.0408	65.0806	62.8961	60.4599	59.0752	60.6106	62.2937	64.9095	67.9332	70.3790	(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) 132.5005 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.1436	141.0656	137.3173	131.6175	126.9890	122.0129	120.1006	123.8328	127.7689	132.9929	138.7805	143.7698	(44)
Energy conte	228.2883	200.8756	211.0515	180.1778	170.9515	150.0290	145.2512	153.3308	157.5518	180.4702	197.7182	225.1088	(45)

Energy content (annual) Total = Sum(45)m = 2200.8050

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

34.2432	30.1313	31.6577	27.0267	25.6427	22.5044	21.7877	22.9996	23.6328	27.0705	29.6577	33.7663	(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

279.2472	246.9030	262.0104	229.4929	221.9104	199.3441	196.2101	204.2897	206.8669	231.4291	247.0333	276.0677	(62)
WWHRS -32.2981	-28.5647	-29.9113	-24.7677	-23.0826	-19.7520	-18.5143	-19.6881	-20.4362	-24.0920	-27.2933	-31.7000	(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

246.9491	218.3383	232.0992	204.7252	198.8278	179.5921	177.6958	184.6016	186.4308	207.3371	219.7400	244.3677	(64)

Total per year (kWh/year) = Sum(64)m = 2500.7047 (64)

12Total per year (kWh/year) 2501 (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

88.6456	78.2980	82.9144	72.2379	69.5811	62.2134	61.0358	63.7222	64.7148	72.7461	78.0701	87.5884	(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	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 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)

-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)

119.1473	116.5149	111.4440	100.3304	93.5230	86.4075	82.0373	85.6482	89.8816	97.7770	108.4307	117.7264	(72)

Total internal gains

581.0176	595.3045	569.1856	547.9180	518.2967	495.3110	474.9720	475.8665	491.3638	512.4130	545.8807	568.0466	(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	0.6300	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	703.6750	818.0362	912.7708	1042.2836	1137.2581	1139.1764	1083.4497	986.4438	886.1449	768.8394	695.2564	671.4521	(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	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	0.9965	0.9919	0.9801	0.9341	0.8155	0.6220	0.4636	0.5268	0.7909	0.9619	0.9924	0.9972	(86)
MIT	19.6732	19.8654	20.1519	20.5431	20.8374	20.9688	20.9943	20.9894	20.8975	20.5085	20.0262	19.6444	(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	0.9953	0.9893	0.9733	0.9118	0.7607	0.5346	0.3597	0.4164	0.7115	0.9444	0.9894	0.9963	(89)
MIT 2	18.4229	18.6694	19.0330	19.5194	19.8463	19.9710	19.9863	19.9861	19.9164	19.4894	18.8831	18.3923	(90)
Living area fraction										fLA = Living area / (4) =		0.1322	(91)
MIT	18.5882	18.8274	19.1809	19.6547	19.9773	20.1028	20.1195	20.1187	20.0460	19.6240	19.0341	18.5578	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5882	18.8274	19.1809	19.6547	19.9773	20.1028	20.1195	20.1187	20.0460	19.6240	19.0341	18.5578	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9930	0.9851	0.9663	0.9032	0.7606	0.5449	0.3734	0.4309	0.7169	0.9363	0.9854	0.9944	(94)
Useful gains	698.7366	805.8478	882.0441	941.4395	865.0052	620.7682	404.5235	425.0556	635.2741	719.8764	685.0993	667.6734	(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	1694.6796	1647.9907	1497.0124	1255.7516	964.4809	635.0178	406.1499	428.3567	688.7328	1051.4959	1396.4086	1687.3285	(97)
Space heating kWh	740.9816	565.9200	457.5364	226.3048	74.0099	0.0000	0.0000	0.0000	0.0000	246.7250	512.1427	758.6234	(98a)
Space heating requirement - total per year (kWh/year)												3582.2437	
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	740.9816	565.9200	457.5364	226.3048	74.0099	0.0000	0.0000	0.0000	0.0000	246.7250	512.1427	758.6234	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3582.2437	
Space heating per m2										(98c) / (4) =		34.6311	(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	740.9816	565.9200	457.5364	226.3048	74.0099	0.0000	0.0000	0.0000	0.0000	246.7250	512.1427	758.6234	(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)	801.9282	612.4675	495.1693	244.9186	80.0973	0.0000	0.0000	0.0000	0.0000	267.0184	554.2669	821.0210	(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	246.9491	218.3383	232.0992	204.7252	198.8278	179.5921	177.6958	184.6016	186.4308	207.3371	219.7400	244.3677	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.5821	86.3261	85.8071	84.5967	82.4639	80.3000	80.3000	80.3000	80.3000	84.7551	86.1305	86.6393	(217)
Fuel for water heating, kWh/month	285.2196	252.9228	270.4893	242.0013	241.1088	223.6515	221.2899	229.8899	232.1678	244.6307	255.1246	282.0519	(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	27.5435	22.0964	19.8954	14.5762	11.2591	9.1988	10.2709	13.3505	17.3410	22.7523	25.6987	28.3090	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.8558	-10.7763	-17.2449	-21.6546	-25.4404	-24.5272	-24.2260	-21.8010	-17.9627	-13.2405	-7.9192	-5.8048	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1095	-2.4486	-5.0939	-8.0045	-10.9496	-11.1447	-11.0192	-9.1623	-6.4987	-3.6163	-1.5157	-0.8694	(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	3876.8871 (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	2980.5481 (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)	222.2918 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-268.8856 (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	6896.8415 (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	3876.8871	0.2100	814.1463	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2980.5481	0.2100	625.9151	(264)
Space and water heating			1440.0614	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	222.2918	0.1443	32.0836	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-197.4534	0.1324	-26.1431	
PV Unit electricity exported	-71.4322	0.1246	-8.8998	
Total			-35.0429	(269)
Total CO2, kg/year			1449.0313	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.0100	(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	3876.8871	1.1300	4380.8825	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2980.5481	1.1300	3368.0194	(278)
Space and water heating			7748.9019	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	222.2918	1.5338	340.9586	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-197.4534	1.4892	-294.0489	
PV Unit electricity exported	-71.4322	0.4573	-32.6637	
Total			-326.7126	(283)
Total Primary energy kWh/year			7893.2487	(286)
Target Primary Energy Rate (TPER)			76.3100	(287)

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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---
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	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) =	83.7000 (23c)

Effective ac	0.5756	0.5659	0.5562	0.5078	0.4981	0.4496	0.4496	0.4399	0.4690	0.4981	0.5174	0.5368	(25)

---
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K

Windows (Uw = 1.50)			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	79.5660	78.2268	76.8876	70.1916	68.8524	62.1564	62.1564	60.8171	64.8348	68.8524	71.5308	74.2092	(38)
Heat transfer coeff	198.3448	197.0056	195.6664	188.9703	187.6311	180.9351	180.9351	179.5959	183.6135	187.6311	190.3096	192.9880	(39)
Average = Sum(39)m / 12 =												188.6355	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4431	1.4334	1.4236	1.3749	1.3652	1.3165	1.3165	1.3067	1.3360	1.3652	1.3847	1.4042	(40)
HLP (average)												1.3725	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9120 (42)
Hot water usage for mixer showers	73.0453	71.9476	70.3479	67.2874	65.0288	62.5100	61.0783	62.6658	64.4060	67.1104	70.2367	72.7654 (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)												136.9944 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.0326	145.8501	141.9745	136.0815	131.2959	126.1510	124.1739	128.0328	132.1025	137.5037	143.4876	148.6462	(44)
Energy conte	236.0313	207.6886	218.2096	186.2888	176.7495	155.1174	150.1776	158.5313	162.8956	186.5913	204.4243	232.7440	(45)
Energy content (annual)										Total = Sum(45)m =		2275.4493	
Distribution loss (46)m = 0.15 x (45)m	35.4047	31.1533	32.7314	27.9433	26.5124	23.2676	22.5266	23.7797	24.4343	27.9887	30.6637	34.9116	(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	286.9902	253.7160	269.1685	235.6038	227.7084	204.4324	201.1365	209.4903	212.2107	237.5502	253.7394	283.7029	(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	286.9902	253.7160	269.1685	235.6038	227.7084	204.4324	201.1365	209.4903	212.2107	237.5502	253.7394	283.7029	(64)
									Total per year (kWh/year) = Sum(64)m =			2875.4493	(64)
12Total per year (kWh/year)												2875	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.2201	80.5633	85.2944	74.2698	71.5089	63.9053	62.6738	65.4514	66.4916	74.7813	80.2999	90.1271	(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	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	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)	-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)	122.6077	119.8859	114.6430	103.1525	96.1142	88.7573	84.2390	87.9723	92.3494	100.5125	111.5276	121.1386	(72)
Total internal gains	659.8580	677.5759	647.0593	623.8768	589.9318	564.7027	541.2919	541.8450	559.6059	582.4610	620.3828	644.8660	(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)

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	786.9797	907.8524	1000.8368	1130.6966	1222.7165	1222.2445	1162.9741	1064.6068	965.3600	847.1881	775.0943	752.1000 (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	48.1205	48.4476	48.7792	50.5076	50.8681	52.7506	52.7506	53.1440	51.9812	50.8681	50.1522	49.4562	
alpha	4.2080	4.2298	4.2519	4.3672	4.3912	4.5167	4.5167	4.5429	4.4654	4.3912	4.3435	4.2971	
util living area													
	0.9982	0.9964	0.9923	0.9761	0.9264	0.7959	0.6401	0.7032	0.9086	0.9853	0.9966	0.9986	(86)
MIT	19.1291	19.3185	19.6300	20.1137	20.5405	20.8598	20.9608	20.9413	20.7059	20.1619	19.5991	19.1430	(87)
Th 2	19.7304	19.7378	19.7452	19.7826	19.7901	19.8280	19.8280	19.8356	19.8128	19.7901	19.7751	19.7601	(88)
util rest of house													
	0.9975	0.9951	0.9892	0.9656	0.8907	0.7013	0.4908	0.5581	0.8492	0.9771	0.9951	0.9980	(89)
MIT 2	18.0456	18.2398	18.5554	19.0598	19.4682	19.7607	19.8179	19.8182	19.6399	19.1172	18.5477	18.0812	(90)
Living area fraction										fLA = Living area / (4) =		0.1430	(91)
MIT	18.2006	18.3941	18.7091	19.2106	19.6216	19.9180	19.9814	19.9789	19.7924	19.2666	18.6981	18.2331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2006	18.3941	18.7091	19.2106	19.6216	19.9180	19.9814	19.9789	19.7924	19.2666	18.6981	18.2331	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9930	0.9855	0.9588	0.8844	0.7097	0.5120	0.5780	0.8479	0.9718	0.9931	0.9971	(94)
Useful gains	784.0996	901.4775	986.2967	1084.1133	1081.3684	867.3784	595.4051	615.3479	818.5630	823.3123	769.7360	749.8892	(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													
	2757.1077	2658.4190	2388.9047	1948.3885	1486.3421	962.2053	611.8162	642.7495	1045.2051	1626.1310	2207.2347	2708.2121	(97)
Space heating kWh													
	1467.9180	1180.6647	1043.5403	622.2781	301.3004	0.0000	0.0000	0.0000	0.0000	597.2971	1034.9991	1456.9923	(98a)
Space heating requirement - total per year (kWh/year)												7704.9901	
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													
	1467.9180	1180.6647	1043.5403	622.2781	301.3004	0.0000	0.0000	0.0000	0.0000	597.2971	1034.9991	1456.9923	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7704.9901	
Space heating per m2											(98c) / (4) =	56.0608	(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	1700.7901	1338.9199	1364.9290	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7067	0.7950	0.7454	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1201.8704	1064.4934	1017.3787	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1330.7613	1265.8688	1155.2937	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	92.8014	149.8233	102.6087	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	0.9968	(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	23.1261	37.3359	25.5701	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												86.0321	(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													
	1467.9180	1180.6647	1043.5403	622.2781	301.3004	0.0000	0.0000	0.0000	0.0000	597.2971	1034.9991	1456.9923	(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)													
	1739.2394	1398.8918	1236.4222	737.2964	356.9910	0.0000	0.0000	0.0000	0.0000	707.6980	1226.3023	1726.2942	(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													
	286.9902	253.7160	269.1685	235.6038	227.7084	204.4324	201.1365	209.4903	212.2107	237.5502	253.7394	283.7029	(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													
	321.0181	283.7987	301.0833	263.5390	254.7074	228.6716	224.9849	234.3291	237.3721	265.7161	283.8248	317.3410	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	5.3782	8.6828	5.9465	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	56.0056	50.5857	56.0056	54.1990	56.0056	54.1990	56.0056	56.0056	54.1990	56.0056	54.1990	56.0056	(231)
Lighting	29.5941	23.7415	21.3766	15.6614	12.0973	9.8836	11.0356	14.3444	18.6320	24.4462	27.6119	30.4166	(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 9129.1352 (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 3216.3862 (219)
Space cooling fuel 20.0075 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1220)
mechanical ventilation fans (SFP = 1.1220) 573.4213 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 659.4213 (231)
Electricity for lighting (calculated in Appendix L) 238.8412 (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 13263.7913 (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	9129.1352	0.2100	1917.1184	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3216.3862	0.2100	675.4411	(264)
Space and water heating			2592.5595	(265)
Space cooling	20.0075	0.1137	2.2752	(266)
Pumps, fans and electric keep-hot	659.4213	0.1387	91.4699	(267)
Energy for lighting	238.8412	0.1443	34.4722	(268)
Total CO2, kg/year			2720.7767	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			19.8000	(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	9129.1352	1.1300	10315.9227 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3216.3862	1.1300	3634.5164 (278)
Space and water heating			13950.4391 (279)
Space cooling	20.0075	1.4192	28.3951 (280)
Pumps, fans and electric keep-hot	659.4213	1.5128	997.5726 (281)
Energy for lighting	238.8412	1.5338	366.3426 (282)
Total Primary energy kWh/year			15342.7494 (286)
Dwelling Primary energy Rate (DPER)			111.6300 (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	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)
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	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9120 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.0453	71.9476	70.3479	67.2874	65.0288	62.5100	61.0783	62.6658	64.4060	67.1104	70.2367	72.7654	(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) 136.9944 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.0326	145.8501	141.9745	136.0815	131.2959	126.1510	124.1739	128.0328	132.1025	137.5037	143.4876	148.6462	(44)
Energy conte	236.0313	207.6886	218.2096	186.2888	176.7495	155.1174	150.1776	158.5313	162.8956	186.5913	204.4243	232.7440	(45)

Energy content (annual) Total = Sum(45)m = 2275.4493

Distribution loss (46)m = 0.15 x (45)m	35.4047	31.1533	32.7314	27.9433	26.5124	23.2676	22.5266	23.7797	24.4343	27.9887	30.6637	34.9116	(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	286.9902	253.7160	269.1685	235.6038	227.7084	204.4324	201.1365	209.4903	212.2107	237.5502	253.7394	283.7029	(62)
WWHRS	-33.3933	-29.5333	-30.9255	-25.6076	-23.8653	-20.4217	-19.1421	-20.3557	-21.1291	-24.9089	-28.2188	-32.7749	(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	253.5969	224.1828	238.2430	209.9963	203.8431	184.0107	181.9944	189.1345	191.0816	212.6413	225.5207	250.9280	(64)

Total per year (kWh/year) = Sum(64)m = 2565.1731 (64)

12Total per year (kWh/year) 2565 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	91.2201	80.5633	85.2944	74.2698	71.5089	63.9053	62.6738	65.4514	66.4916	74.7813	80.2999	90.1271	(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	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	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)	-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)	122.6077	119.8859	114.6430	103.1525	96.1142	88.7573	84.2390	87.9723	92.3494	100.5125	111.5276	121.1386	(72)
Total internal gains	659.8580	677.5759	647.0593	623.8768	589.9318	564.7027	541.2919	541.8450	559.6059	582.4610	620.3828	644.8660	(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	0.6300	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	789.0300	911.5665	1006.5428	1138.8711	1232.9227	1232.8500	1173.0012	1073.0385	971.9044	851.4579	777.5896	753.8295	(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	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	0.9984	0.9960	0.9895	0.9596	0.8646	0.6757	0.5061	0.5721	0.8372	0.9775	0.9962	0.9988	(86)
MIT	19.7611	19.9278	20.1801	20.5382	20.8280	20.9678	20.9946	20.9898	20.8949	20.5193	20.0815	19.7363	(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	0.9979	0.9947	0.9858	0.9449	0.8195	0.5928	0.4044	0.4651	0.7689	0.9666	0.9947	0.9984	(89)
MIT 2	18.6114	18.8259	19.1484	19.6008	19.9341	20.0708	20.0877	20.0871	20.0120	19.5855	19.0296	18.5850	(90)
Living area fraction										fLA = Living area / (4) =		0.1430	(91)
MIT	18.7759	18.9836	19.2960	19.7349	20.0620	20.1991	20.2174	20.2162	20.1383	19.7191	19.1801	18.7497	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7759	18.9836	19.2960	19.7349	20.0620	20.1991	20.2174	20.2162	20.1383	19.7191	19.1801	18.7497	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9925	0.9815	0.9380	0.8184	0.6033	0.4189	0.4803	0.7733	0.9607	0.9926	0.9974	(94)
Useful gains	786.4471	904.7059	987.9419	1068.2238	1009.0758	743.7420	491.3967	515.3362	751.5528	818.0266	771.8147	751.9015	(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	2026.8089	1967.4765	1783.6773	1494.7118	1151.3138	763.8834	493.5247	519.7624	826.7215	1255.5553	1669.8203	2019.4814	(97)
Space heating kWh	922.8292	714.1819	592.0271	307.0713	105.8251	0.0000	0.0000	0.0000	0.0000	325.5214	646.5641	943.0795	(98a)
Space heating requirement - total per year (kWh/year)												4557.0995	
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	922.8292	714.1819	592.0271	307.0713	105.8251	0.0000	0.0000	0.0000	0.0000	325.5214	646.5641	943.0795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4557.0995	
Space heating per m2											(98c) / (4) =	33.1570	(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	922.8292	714.1819	592.0271	307.0713	105.8251	0.0000	0.0000	0.0000	0.0000	325.5214	646.5641	943.0795	(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)	998.7329	772.9241	640.7220	332.3283	114.5294	0.0000	0.0000	0.0000	0.0000	352.2958	699.7446	1020.6488	(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	253.5969	224.1828	238.2430	209.9963	203.8431	184.0107	181.9944	189.1345	191.0816	212.6413	225.5207	250.9280	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8939	86.6821	86.2494	85.1944	83.0454	80.3000	80.3000	80.3000	80.3000	85.2907	86.5042	86.9431	(217)
Fuel for water heating, kWh/month	291.8466	258.6264	276.2256	246.4907	245.4598	229.1540	226.6431	235.5349	237.9596	249.3135	260.7048	288.6116	(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	33.4708	26.8515	24.1768	17.7130	13.6820	11.1783	12.4812	16.2235	21.0727	27.6486	31.2290	34.4011	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.9324	-10.9407	-17.5763	-22.1577	-26.1084	-25.1966	-24.8858	-22.3579	-18.3692	-13.4764	-8.0221	-5.8651	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.0328	-2.2842	-4.7624	-7.5013	-10.2816	-10.4753	-10.3593	-8.6054	-6.0922	-3.3804	-1.4128	-0.8091 (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	4931.9259 (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	3046.5706 (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)	270.1285 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-268.8856 (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	8065.7394 (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	4931.9259	0.2100	1035.7044	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3046.5706	0.2100	639.7798	(264)
Space and water heating			1675.4843	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	270.1285	0.1443	38.9879	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-201.8888	0.1323	-26.7157	
PV Unit electricity exported	-66.9968	0.1245	-8.3424	
Total			-35.0582	(269)
Total CO2, kg/year			1691.3433	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100	(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	4931.9259	1.1300	5573.0762	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3046.5706	1.1300	3442.6248	(278)
Space and water heating			9015.7010	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	270.1285	1.5338	414.3321	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-201.8888	1.4889	-300.5991	
PV Unit electricity exported	-66.9968	0.4570	-30.6176	
Total			-331.2168	(283)
Total Primary energy kWh/year			9228.9172	(286)
Target Primary Energy Rate (TPER)			67.1500	(287)

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 FABRIC ENERGY EFFICIENCY

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.0000	(1b)	x 3.1100	(2b) =	161.7200	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		161.7200	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1237 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		10.0000 (17)
Infiltration rate		0.6237 (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) =	0.4833 (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	0.6163	0.6042	0.5921	0.5317	0.5196	0.4592	0.4592	0.4471	0.4833	0.5196	0.5438	0.5679	(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	0.6899	0.6825	0.6753	0.6413	0.6350	0.6054	0.6054	0.5999	0.6168	0.6350	0.6478	0.6613	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.50)			15.1200	1.4151	21.3962			(27)
Solid Door			1.8900	3.0000	5.6700			(26)
1F			52.0000	0.2500	13.0000			(28b)
External Wall 1	58.5900	17.0100	41.5800	0.3000	12.4740			(29a)
Total net area of external elements Aum(A, m2)			110.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5402			(33)

Party Wall 1							38.5300	0.0000	0.0000				(32)
Party Ceiling 1							52.0000						(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000	(35)
Thermal bridges (Default value 0.200 * total exposed area)												22.1180	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		74.6582	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.8178	36.4243	36.0386	34.2268	33.8879	32.3099	32.3099	32.0177	32.9177	33.8879	34.5736	35.2905	(38)
Heat transfer coeff	111.4760	111.0825	110.6968	108.8851	108.5461	106.9681	106.9681	106.6759	107.5760	108.5461	109.2318	109.9487	(39)
Average = Sum(39)m / 12 =												108.8835	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.1438	2.1362	2.1288	2.0939	2.0874	2.0571	2.0571	2.0515	2.0688	2.0874	2.1006	2.1144	(40)
HLP (average)												2.0939	
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	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)

---

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	g Specific data	FF Specific data	Access factor	Gains W

					W/m2	or Table 6b		or Table 6c		Table 6d			
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)
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	395.2343	471.5343	546.2172	652.1434	732.6015	743.6434	706.8924	631.5124	549.1665	454.3264	395.8513	375.5085	(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	32.3936	32.5084	32.6216	33.1644	33.2680	33.7588	33.7588	33.8512	33.5680	33.2680	33.0591	32.8436	
alpha	3.1596	3.1672	3.1748	3.2110	3.2179	3.2506	3.2506	3.2567	3.2379	3.2179	3.2039	3.1896	
util living area	0.9941	0.9892	0.9782	0.9443	0.8681	0.7322	0.5937	0.6613	0.8640	0.9674	0.9900	0.9950	(86)
MIT	18.4363	18.6897	19.1266	19.7657	20.3423	20.7521	20.9098	20.8706	20.5271	19.7861	19.0206	18.4163	(87)
Th 2	19.2392	19.2441	19.2489	19.2714	19.2757	19.2956	19.2956	19.2992	19.2879	19.2757	19.2671	19.2582	(88)
util rest of house	0.9919	0.9850	0.9693	0.9196	0.8050	0.6000	0.3945	0.4641	0.7702	0.9480	0.9854	0.9932	(89)
MIT 2	17.0166	17.2712	17.7061	18.3398	18.8661	19.1963	19.2788	19.2705	19.0492	18.3759	17.6171	17.0090	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	17.6814	17.9355	18.3713	19.0075	19.5574	19.9248	20.0426	20.0198	19.7413	19.0363	18.2743	17.6680	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6814	17.9355	18.3713	19.0075	19.5574	19.9248	20.0426	20.0198	19.7413	19.0363	18.2743	17.6680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9889	0.9805	0.9631	0.9147	0.8173	0.6548	0.4890	0.5569	0.8007	0.9443	0.9815	0.9906	(94)
Useful gains	390.8452	462.3465	526.0399	596.4941	598.7730	486.9492	345.6521	351.6669	439.7060	429.0119	388.5355	371.9734	(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	1491.7008	1448.0118	1314.1105	1100.5591	852.8889	569.5870	368.2443	386.1450	606.8637	915.7224	1220.5941	1480.7884	(97)
Space heating kWh	819.0366	662.3670	586.3245	362.9268	189.0623	0.0000	0.0000	0.0000	0.0000	362.1126	599.0822	824.9584	(98a)
Space heating requirement - total per year (kWh/year)												4405.8704	
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	819.0366	662.3670	586.3245	362.9268	189.0623	0.0000	0.0000	0.0000	0.0000	362.1126	599.0822	824.9584	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4405.8704	
Space heating per m2											(98c) / (4) =	84.7283	(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	1005.5005	791.5643	810.7370	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6929	0.7689	0.7142	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	696.6650	608.6361	579.0015	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	841.7040	800.2693	713.6337	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.4281	142.5751	100.1663	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	26.1070	35.6438	25.0416	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												86.7924	(107)
Energy for space heating												84.7283	(99)
Energy for space cooling												1.6691	(108)
Total												86.3974	(109)
Fabric Energy Efficiency (DFEE)												86.4	(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	52.0000 (1b)	x	3.1100 (2b)	=	161.7200 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	161.7200	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1237	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3737	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3692	0.3620	0.3548	0.3186	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
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	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			11.1100	1.1450	12.7214			(27)
1F			52.0000	0.1300	6.7600			(28b)
External Wall 1	58.5900	13.0000	45.5900	0.1800	8.2062			(29a)
Total net area of external elements Aum(A, m2)			110.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.5776			(33)
Party Wall 1			38.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	5.5295	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 35.1071	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.3217	30.1804	30.0420	29.3916	29.2699	28.7034	28.7034	28.5985	28.9216	29.2699	29.5161	29.7734	(38)
Heat transfer coeff	65.4288	65.2875	65.1490	64.4987	64.3770	63.8105	63.8105	63.7056	64.0287	64.3770	64.6231	64.8805	(39)
Average = Sum(39)m / 12 =												64.4981	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2582	1.2555	1.2529	1.2404	1.2380	1.2271	1.2271	1.2251	1.2313	1.2380	1.2428	1.2477	(40)
HLP (average)												1.2403	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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)

---

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)

---

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	375.8380	435.0602	487.3225	564.1860	620.4090	626.2619	596.2237	539.8391	480.3550	411.5803	371.9864	359.3235	(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	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													
	0.9955	0.9906	0.9778	0.9293	0.8107	0.6199	0.4640	0.5290	0.7901	0.9591	0.9909	0.9964	(86)
MIT	19.5475	19.7456	20.0527	20.4806	20.8058	20.9590	20.9916	20.9849	20.8735	20.4425	19.9262	19.5175	(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													
	0.9940	0.9874	0.9701	0.9050	0.7526	0.5264	0.3514	0.4095	0.7060	0.9399	0.9872	0.9952	(89)
MIT 2	18.5690	18.7671	19.0710	19.4860	19.7673	19.8812	19.8964	19.8961	19.8302	19.4612	18.9554	18.5455	(90)
Living area fraction										fLA = Living area / (4) =		0.4683	(91)
MIT	19.0272	19.2253	19.5307	19.9518	20.2536	20.3859	20.4093	20.4059	20.3187	19.9207	19.4100	19.0006	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0272	19.2253	19.5307	19.9518	20.2536	20.3859	20.4093	20.4059	20.3187	19.9207	19.4100	19.0006	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9850	0.9672	0.9066	0.7732	0.5691	0.4043	0.4657	0.7410	0.9406	0.9851	0.9939	(94)
Useful gains	373.0260	428.5384	471.3209	511.4984	479.6877	356.4278	241.0716	251.3998	355.9659	387.1171	366.4595	357.1229	(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	963.5815	935.2650	848.9365	712.8231	550.6560	369.2007	243.0711	255.1988	398.1781	600.0392	795.5100	960.2729	(97)
Space heating kWh	439.3733	340.5203	280.9460	144.9537	52.8004	0.0000	0.0000	0.0000	0.0000	158.4140	308.9163	448.7436	(98a)
Space heating requirement - total per year (kWh/year)												2174.6677	
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	439.3733	340.5203	280.9460	144.9537	52.8004	0.0000	0.0000	0.0000	0.0000	158.4140	308.9163	448.7436	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2174.6677	
Space heating per m2											(98c) / (4) =	41.8205	(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	599.8189	472.1979	484.1627	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8859	0.9362	0.9055	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	531.4063	442.0519	438.4177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	704.3630	670.7804	606.3508	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	124.5288	170.1740	124.9422	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	31.1322	42.5435	31.2356	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												104.9113	(107)
Energy for space heating												41.8205	(99)
Energy for space cooling												2.0175	(108)
Total												43.8381	(109)
Fabric Energy Efficiency (TFEE)												43.8	(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 FABRIC ENERGY EFFICIENCY

---

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		10.0000 (17)
Infiltration rate		0.6348 (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) =	0.4919 (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	0.6272	0.6149	0.6026	0.5411	0.5288	0.4674	0.4674	0.4551	0.4919	0.5288	0.5534	0.5780	(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	0.6967	0.6891	0.6816	0.6464	0.6398	0.6092	0.6092	0.6035	0.6210	0.6398	0.6531	0.6671	(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	34.1193	33.7452	33.3786	31.6564	31.3341	29.8341	29.8341	29.5564	30.4119	31.3341	31.9860	32.6675	(38)
Heat transfer coeff	103.9389	103.5648	103.1981	101.4759	101.1537	99.6537	99.6537	99.3759	100.2315	101.1537	101.8055	102.4870	(39)

Average = Sum(39)m / 12 = 101.4744

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9611	1.9541	1.9471	1.9146	1.9086	1.8803	1.8803	1.8750	1.8912	1.9086	1.9209	1.9337	(40)
HLP (average)												1.9146	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7786 (42)
Hot water usage for mixer showers

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

23.3623	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) 51.5189 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	56.2065	54.6652	52.9823	50.8871	49.0181	47.0758	46.6718	48.3513	50.0739	52.0686	54.1824	56.1275	(44)
Energy conte	89.0174	77.8425	81.4318	69.6618	65.9878	57.8852	56.4455	59.8690	61.7461	70.6566	77.1928	87.8821	(45)

Energy content (annual) Total = Sum(45)m = 855.6187

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

75.6648	66.1661	69.2170	59.2126	56.0897	49.2024	47.9787	50.8887	52.4842	60.0581	65.6138	74.6998	(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

75.6648	66.1661	69.2170	59.2126	56.0897	49.2024	47.9787	50.8887	52.4842	60.0581	65.6138	74.6998	(64)

Total per year (kWh/year) = Sum(64)m = 727.2759 (64)
12Total per year (kWh/year) 727 (64)
Electric shower(s)

43.2771	38.5603	42.1064	40.1816	40.9356	39.0486	40.3502	40.9356	40.1816	42.1064	41.3146	43.2771	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 492.2750 (64a)
Heat gains from water heating, kWh/month

29.7355	26.1816	27.8308	24.8485	24.2563	22.0627	22.0822	22.9561	23.1665	25.5411	26.7321	29.4942	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.1887	86.5660	78.1887	80.7950	78.1887	80.7950	78.1887	78.1887	80.7950	78.1887	80.7950	78.1887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	39.9670	38.9607	37.4070	34.5119	32.6026	30.6427	29.6804	30.8549	32.1756	34.3295	37.1279	39.6428	(72)
Total internal gains	322.8519	331.8316	317.8469	308.9283	293.5193	283.9275	273.5191	273.0850	281.0656	289.2429	305.5410	315.6879	(73)

---

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	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	400.1908	469.9033	526.0582	603.2866	659.3444	663.7741	632.7383	575.9231	518.3552	446.8057	399.2690	381.1984 (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	35.4108	35.5387	35.6649	36.2702	36.3858	36.9335	36.9335	37.0367	36.7206	36.3858	36.1528	35.9124	
alpha	3.3607	3.3692	3.3777	3.4180	3.4257	3.4622	3.4622	3.4691	3.4480	3.4257	3.4102	3.3942	
util living area	0.9944	0.9899	0.9808	0.9531	0.8883	0.7602	0.6188	0.6796	0.8717	0.9687	0.9904	0.9953	(86)
MIT	18.6424	18.8790	19.2684	19.8410	20.3691	20.7622	20.9162	20.8826	20.5728	19.8997	19.1915	18.6241	(87)
Th 2	19.3594	19.3641	19.3688	19.3908	19.3950	19.4144	19.4144	19.4180	19.4069	19.3950	19.3866	19.3779	(88)
util rest of house	0.9924	0.9861	0.9731	0.9323	0.8335	0.6377	0.4281	0.4933	0.7851	0.9506	0.9860	0.9936	(89)
MIT 2	17.3009	17.5389	17.9274	18.4994	18.9884	19.3135	19.3972	19.3897	19.1842	18.5688	17.8664	17.2951	(90)
Living area fraction									fLA = Living area / (4) =			0.5202	(91)
MIT	17.9988	18.2360	18.6250	19.1973	19.7066	20.0671	20.1874	20.1663	19.9065	19.2611	18.5557	17.9864	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9988	18.2360	18.6250	19.1973	19.7066	20.0671	20.1874	20.1663	19.9065	19.2611	18.5557	17.9864	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9899	0.9824	0.9682	0.9291	0.8462	0.6940	0.5281	0.5902	0.8178	0.9486	0.9828	0.9914	(94)
Useful gains	396.1331	461.6286	509.3487	560.5055	557.9502	460.6844	334.1238	339.8835	423.9048	423.8362	392.4207	377.9265	(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	1423.8326	1381.1388	1251.2759	1044.9264	809.8995	544.8167	357.4951	374.2795	581.9974	876.1041	1166.2562	1412.9289	(97)
Space heating kWh	764.6084	617.9108	551.9938	348.7831	187.4503	0.0000	0.0000	0.0000	0.0000	336.4873	557.1616	770.0418	(98a)
Space heating requirement - total per year (kWh/year)												4134.4372	
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	764.6084	617.9108	551.9938	348.7831	187.4503	0.0000	0.0000	0.0000	0.0000	336.4873	557.1616	770.0418	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4134.4372	
Space heating per m2										(98c) / (4) =		78.0082	(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	936.7447	737.4373	755.2569	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6819	0.7627	0.7136	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	638.7335	562.4256	538.9396	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	747.7823	713.0523	648.1424	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	78.5151	112.0662	81.2468	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	19.6288	28.0166	20.3117	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												67.9570	(107)
Energy for space heating												78.0082	(99)
Energy for space cooling												1.2822	(108)
Total												79.2905	(109)
Fabric Energy Efficiency (DFEE)												79.3	(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	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)
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	0.5723	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	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7786	(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	23.3623	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)												51.5189 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	56.2065	54.6652	52.9823	50.8871	49.0181	47.0758	46.6718	48.3513	50.0739	52.0686	54.1824	56.1275 (44)
Energy conte	89.0174	77.8425	81.4318	69.6618	65.9878	57.8852	56.4455	59.8690	61.7461	70.6566	77.1928	87.8821 (45)
Energy content (annual)										Total = Sum(45)m =		855.6187
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												
	75.6648	66.1661	69.2170	59.2126	56.0897	49.2024	47.9787	50.8887	52.4842	60.0581	65.6138	74.6998 (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												
	75.6648	66.1661	69.2170	59.2126	56.0897	49.2024	47.9787	50.8887	52.4842	60.0581	65.6138	74.6998 (64)
										Total per year (kWh/year) = Sum(64)m =		727.2759 (64)
12Total per year (kWh/year)												727 (64)
Electric shower(s)												
	43.2771	38.5603	42.1064	40.1816	40.9356	39.0486	40.3502	40.9356	40.1816	42.1064	41.3146	43.2771 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						492.2750 (64a)
Heat gains from water heating, kWh/month												
	29.7355	26.1816	27.8308	24.8485	24.2563	22.0627	22.0822	22.9561	23.1665	25.5411	26.7321	29.4942 (65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	78.3035	86.6931	78.3035	80.9136	78.3035	80.9136	78.3035	78.3035	80.9136	78.3035	80.9136	78.3035	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)													
	39.9670	38.9607	37.4070	34.5119	32.6026	30.6427	29.6804	30.8549	32.1756	34.3295	37.1279	39.6428	(72)
Total internal gains													
	322.9667	331.9587	317.9617	309.0470	293.6341	284.0461	273.6339	273.1998	281.1843	289.3577	305.6597	315.8027	(73)

---

6. Solar gains

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

Solar gains	64.8191	115.7223	174.5142	246.7286	306.6399	318.3965	301.1047	253.8396	198.8895	132.0599	78.5554	54.9053	(83)
Total gains	387.7858	447.6810	492.4759	555.7756	600.2740	602.4426	574.7386	527.0394	480.0738	421.4176	384.2151	370.7080	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.8589	54.9716	55.0824	55.6090	55.7087	56.1773	56.1773	56.2649	55.9959	55.7087	55.5074	55.2986
alpha	4.6573	4.6648	4.6722	4.7073	4.7139	4.7452	4.7452	4.7510	4.7331	4.7139	4.7005	4.6866
util living area												
	0.9953	0.9902	0.9787	0.9374	0.8345	0.6527	0.4919	0.5531	0.8013	0.9589	0.9904	0.9962 (86)
MIT	19.5452	19.7423	20.0347	20.4439	20.7744	20.9481	20.9890	20.9813	20.8630	20.4375	19.9253	19.5140 (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												
	0.9937	0.9870	0.9713	0.9151	0.7792	0.5569	0.3729	0.4288	0.7182	0.9396	0.9866	0.9949 (89)
MIT 2	18.5621	18.7591	19.0486	19.4476	19.7381	19.8690	19.8886	19.8878	19.8171	19.4509	18.9493	18.5372 (90)
Living area fraction										fLA = Living area / (4) =		0.5202 (91)
MIT	19.0735	19.2706	19.5616	19.9659	20.2771	20.4303	20.4610	20.4566	20.3611	19.9641	19.4570	19.0453 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0735	19.2706	19.5616	19.9659	20.2771	20.4303	20.4610	20.4566	20.3611	19.9641	19.4570	19.0453 (93)