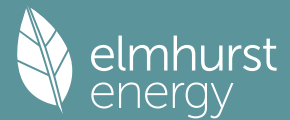


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External Wall 1	93.2700	18.7500	74.5200	0.1500	11.1780	14.0000	1043.2800 (29a)
Total net area of external elements Aum(A, m2)	93.2700						(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	28.1206			(33)
Party Wall 1			13.6700	0.0000	0.0000	20.0000	273.4000 (32)
Party Floor 1			88.0000			40.0000	3520.0000 (32d)
Party Ceiling 1			88.0000			30.0000	2640.0000 (32b)
Internal Wall 1			103.6100			9.0000	932.4900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8409.1700 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 95.5587 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E7 Party floor between dwellings (in blocks of flats)	72.3000	0.0700	5.0610				
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	5.9800	0.4430	2.6491				
E16 Corner (normal)	10.3200	0.0900	0.9288				
E17 Corner (inverted - internal area greater than external area)	2.5800	-0.0900	-0.2322				
E18 Party wall between dwellings	2.5800	0.0600	0.1548				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.6000	0.0000	0.0000				
E1 Steel lintel with perforated steel base plate	10.1000	0.0500	0.5050				
E3 Sill	9.2000	0.0500	0.4600				
E4 Jamb	24.2000	0.0500	1.2100				

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.7365 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 38.8572 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	17.2113	16.9935	16.7758	15.6870	15.4693	14.3806	14.3806	14.1628	14.8161	15.4693	15.9048	16.3403 (38)
Average = Sum(39)m / 12 =	56.0684	55.8507	55.6329	54.5442	54.3265	53.2377	53.2377	53.0200	53.6732	54.3265	54.7620	55.1975 (39)
												54.4898

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6371	0.6347	0.6322	0.6198	0.6173	0.6050	0.6050	0.6025	0.6099	0.6173	0.6223	0.6272 (40)
HLP (average)												0.6192
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5973 (42)
Hot water usage for mixer showers	67.7687	66.7502	65.2662	62.4267	60.3312	57.9944	56.6662	58.1390	59.7535	62.2625	65.1630	67.5090	(42a)
Hot water usage for baths	29.2660	28.8313	28.2193	27.0907	26.2457	25.3087	24.8025	25.4103	26.0721	27.0747	28.2265	29.1670	(42b)
Hot water usage for other uses	41.2294	39.7301	38.2309	36.7316	35.2324	33.7331	33.7331	35.2324	36.7316	38.2309	39.7301	41.2294	(42c)
Average daily hot water use (litres/day)												127.0959	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054	(44)
Energy conte	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266	(45)
Energy content (annual)													
										Total = Sum(45)m =		2111.0357	

Distribution loss (46)m = 0.15 x (45)m												
32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890	(46)

Water storage loss:
 Store volume 172.0000 (47)

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

Temperature factor from Table 2b 0.7800 (49)

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

Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)
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If cylinder contains dedicated solar storage

Primary loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	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)

WWHRS	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (62)
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 (63a)
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 (63b)
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 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (64)
Total per year (kWh/year) = Sum(64)m =												2848.9927 (64)

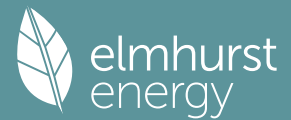
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
EGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Heat gains from water heating, kWh/month	122.9503	109.3551	117.4530	105.9887	104.6636	96.3732	96.4667	99.0436	98.7724	107.6993	111.5829	121.9362 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	120.1473	133.0203	120.1473	124.1522	120.1473	124.1522	120.1473	120.1473	124.1522	120.1473	124.1522	120.1473 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655 (68)
Pumps, fans	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937 (71)
Total internal gains	165.2558	162.7308	157.8669	147.2066	140.6768	133.8516	129.6596	133.1231	137.1838	144.7571	154.9763	163.8928 (72)
	582.7130	595.5032	571.6121	551.8550	524.7819	506.4177	487.8365	488.8578	503.0777	519.7477	550.5103	570.9658 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF		Access factor Table 6d		Gains W
Northeast				11.2800	11.2829	0.4700		0.7000		0.7700		29.0175 (75)
Southeast				1.9800	36.7938	0.4700		0.7000		0.7700		16.6100 (77)
Southwest				3.6000	36.7938	0.4700		0.7000		0.7700		30.2000 (79)
Solar gains	75.8275	138.8007	215.5147	309.9451	386.3324	400.7674	379.2127	319.5904	247.8007	160.3072	92.5791	63.7568 (83)
Total gains	658.5405	734.3039	787.1268	861.8001	911.1143	907.1850	867.0492	808.4482	750.8784	680.0549	643.0894	634.7225 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	41.6612	41.8237	41.9874	42.8254	42.9971	43.8764	43.8764	44.0566	43.5204	42.9971	42.6552	42.3186
util living area	3.7774	3.7882	3.7992	3.8550	3.8665	3.9251	3.9251	3.9371	3.9014	3.8665	3.8437	3.8212
	0.9035	0.8629	0.8012	0.6775	0.5277	0.3705	0.2690	0.2998	0.4768	0.7153	0.8546	0.9117 (86)
MIT	20.0058	20.2257	20.4862	20.7767	20.9283	20.9864	20.9970	20.9955	20.9638	20.7692	20.3796	19.9801 (87)
Th 2	20.3967	20.3989	20.4011	20.4122	20.4144	20.4255	20.4255	20.4278	20.4211	20.4144	20.4100	20.4055 (88)
util rest of house	0.8944	0.8508	0.7846	0.6543	0.4989	0.3385	0.2343	0.2631	0.4404	0.6888	0.8401	0.9032 (89)
MIT 2	19.2248	19.4976	19.8176	20.1710	20.3433	20.4140	20.4235	20.4246	20.3887	20.1702	19.7003	19.1998 (90)
Living area fraction	19.6497	19.8937	20.1813	20.5005	20.6615	20.7254	20.7355	20.7351	20.7015	20.4960	20.0698	19.6243 (92)
MIT												0.0000
Temperature adjustment												0.0000
adjusted MIT	19.6497	19.8937	20.1813	20.5005	20.6615	20.7254	20.7355	20.7351	20.7015	20.4960	20.0698	19.6243 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8816	0.8397	0.7781	0.6579	0.5112	0.3553	0.2531	0.2829	0.4582	0.6926	0.8310	0.8906 (94)
Ext temp.	580.5648	616.5990	612.4903	566.9514	465.7530	322.3124	219.4068	228.6838	344.0754	471.0116	534.4016	565.2813 (95)
Heat loss rate W	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)
Space heating kWh	860.6319	837.4059	761.1319	632.7383	486.8467	326.1023	220.1644	229.8494	354.3253	537.6175	710.2538	851.3795 (97)
Space heating requirement - total per year (kWh/year)	208.3699	148.3823	110.5894	47.3666	15.6937	0.0000	0.0000	0.0000	0.0000	49.5548	126.6136	212.8571 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	208.3699	148.3823	110.5894	47.3666	15.6937	0.0000	0.0000	0.0000	0.0000	49.5548	126.6136	212.8571 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												919.4273
Space heating per m2										(98c) / (4) =		10.4480 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	208.3699	148.3823	110.5894	47.3666	15.6937	0.0000	0.0000	0.0000	0.0000	49.5548	126.6136	212.8571 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	208.3699	148.3823	110.5894	47.3666	15.6937	0.0000	0.0000	0.0000	0.0000	49.5548	126.6136	212.8571
Space heating requirement												

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208.3699	148.3823	110.5894	47.3666	15.6937	0.0000	0.0000	0.0000	0.0000	49.5548	126.6136	212.8571	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating												
Annual water heating requirement	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024
310a	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024
Water heating fuel	281.6522	249.2924	265.1189	233.4827	226.6546	204.5637	202.0024	209.7524	211.7793	235.7846	250.3073	278.6024 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	23.3369	21.0785	23.3369	22.5841	23.3369	22.5841	23.3369	23.3369	22.5841	23.3369	22.5841	23.3369 (331)
Lighting	22.2640	17.8610	16.0818	11.7822	9.1009	7.4355	8.3022	10.7915	14.0171	18.3912	20.7728	22.8827 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year												
Space heating fuel - community heating												919.4273 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2848.9927 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												9.1943 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												274.7729 (330a)
Total electricity for the above, kWh/year												274.7729 (331)
Electricity for lighting (calculated in Appendix L)												179.6829 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4222.8758 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1076.6914	0.1566	41.1498 (367)
Electrical energy for heat distribution (space & water)	9.1943	0.0000	5.4526 (372)
Overall CO2 factor for heat network			0.0428 (386)
Total CO2 associated with community systems			161.2426 (373)
Space and water heating			161.2426 (376)
Pumps, fans and electric keep-hot	274.7729	0.1387	38.1144 (378)
Energy for lighting	179.6829	0.1443	25.9338 (379)
Total CO2, kg/year			225.2907 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.5600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1076.6914	1.5799	415.0315 (467)
Electrical energy for heat distribution (space & water)	9.1943	0.0000	57.8524 (472)
Overall CO2 factor for heat network			0.4540 (486)
Total CO2 associated with community systems			1710.7767 (473)
Space and water heating			1710.7767 (476)
Pumps, fans and electric keep-hot	274.7729	1.5128	415.6764 (478)
Energy for lighting	179.6829	1.5338	275.6036 (479)
Total Primary energy kWh/year			2402.0567 (483)
Dwelling Primary energy Rate (DPER)			27.3000 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.0000 (1b)	2.5800 (2b)	227.0400 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.0000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 227.0400 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1321 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3821 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2962 (21)

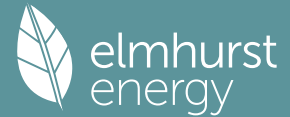
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3776	0.3702	0.3628	0.3258	0.3184	0.2813	0.2813	0.2739	0.2962	0.3184	0.3332	0.3480 (22b)
Effective ac	0.5713	0.5685	0.5658	0.5531	0.5507	0.5396	0.5396	0.5375	0.5439	0.5507	0.5555	0.5605 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			16.8600	1.1450	19.3053		(27)
External Wall 1	93.2700	18.7500	74.5200	0.1800	13.4136		(29a)
Total net area of external elements Aum(A, m ²)			93.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6089		(33)
Party Wall 1			13.6700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							105.5587 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E7 Party floor between dwellings (in blocks of flats)				72.3000	0.0700		5.0610
E23 Balcony within or between dwellings, balcony support penetrates wall insulation				5.9800	0.0200		0.1196
E16 Corner (normal)				10.3200	0.0900		0.9288
E17 Corner (inverted - internal area greater than external area)				2.5800	-0.0900		-0.2322
E18 Party wall between dwellings				2.5800	0.0600		0.1548
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				10.6000	0.0000		0.0000
E1 Steel lintel with perforated steel base plate				10.1000	0.0500		0.5050
E3 Sill				9.2000	0.0500		0.4600
E4 Jamb				24.2000	0.0500		1.2100
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2070 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	42.8159 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.8029	42.5955	42.3922	41.4373	41.2586	40.4269	40.4269	40.2729	40.7473	41.2586	41.6200	41.9979 (38)
Average = Sum(39)m / 12 =	85.6188	85.4114	85.2081	84.2532	84.0745	83.2429	83.2429	83.0888	83.5632	84.0745	84.4360	84.8138 (39)
												84.2523
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9729	0.9706	0.9683	0.9574	0.9554	0.9459	0.9459	0.9442	0.9496	0.9554	0.9595	0.9638 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5973 (42)
Hot water usage for mixer showers												67.5090 (42a)
Hot water usage for baths												29.1670 (42b)
Hot water usage for other uses												41.2294 (42c)
Average daily hot water use (litres/day)												127.0959 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	138.2640	135.3117	131.7163	126.2491	121.8093	117.0362	115.2018	118.7817	122.5572	127.5681	133.1196	137.9054 (44)
Energy content (annual)	218.9764	192.6820	202.4431	172.8287	163.9788	143.9097	139.3266	147.0766	151.1253	173.1088	189.6533	215.9266 (45)
Distribution loss (46)m = 0.15 x (45)m	32.8465	28.9023	30.3665	25.9243	24.5968	21.5865	20.8990	22.0615	22.6688	25.9663	28.4480	32.3890 (46)
Water storage loss:												172.0000 (47)
Store volume												1.5107 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8158 (55)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	267.5284	236.5355	250.9951	219.8145	212.5308	190.8955	187.8787	195.6286	198.1111	221.6608	236.6391	264.4786 (62)
WWHRS	-30.9810	-27.3999	-28.6915	-23.7577	-22.1414	-18.9465	-17.7593	-18.8853	-19.6028	-23.1095	-26.1803	-30.4073 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	236.5474	209.1356	222.3036	196.0568	190.3894	171.9490	170.1193	176.7433	178.5083	198.5512	210.4588	234.0713 (64)
12Total per year (kWh/year)												2394.8342 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	111.6513	99.1495	106.1539	95.0542	93.3646	85.4386	85.1677	87.7446	87.8378	96.4003	100.6484	110.6372 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	129.8672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.1473	133.0203	120.1473	124.1522	120.1473	124.1522	120.1473	120.1473	124.1522	120.1473	124.1522	120.1473	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	235.3498	237.7919	231.6377	218.5360	201.9975	186.4537	176.0694	173.6272	179.7815	192.8831	209.4216	224.9655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	35.9867	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	-103.8937	(71)
Water heating gains (Table 5)	150.0689	147.5439	142.6800	132.0197	125.4900	118.6648	114.4728	117.9363	121.9970	129.5703	139.7894	148.7059	(72)
Total internal gains	570.5261	583.3163	559.4252	539.6681	512.5950	491.2308	472.6496	473.6709	487.8908	507.5609	538.3235	558.7789	(73)

6. Solar gains

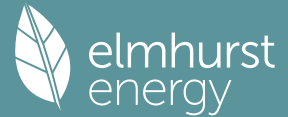
[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				

Northeast			11.2800	11.2829	0.6300	0.7000	0.7700	38.8958 (75)				
Southeast			1.9800	36.7938	0.6300	0.7000	0.7700	22.2645 (77)				
Southwest			3.6000	36.7938	0.6300	0.7000	0.7700	40.4808 (79)				

Solar gains	101.6411	186.0520	288.8814	415.4583	517.8498	537.1988	508.3064	428.3871	332.1584	214.8799	124.0954	85.4612 (83)
Total gains	672.1673	769.3684	848.3066	955.1265	1030.4448	1028.4296	980.9560	902.0581	820.0492	722.4408	662.4189	644.2401 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	30.1374	30.2105	30.2826	30.6258	30.6909	30.9976	30.9976	31.0550	30.8787	30.6909	30.5595	30.4234
alpha	3.0092	3.0140	3.0188	3.0417	3.0461	3.0665	3.0665	3.0703	3.0586	3.0461	3.0373	3.0282
util living area	0.9425	0.9152	0.8708	0.7765	0.6414	0.4823	0.3618	0.4057	0.6097	0.8194	0.9149	0.9484 (86)
MIT	19.1018	19.3992	19.8136	20.3342	20.7099	20.9117	20.9726	20.9608	20.8158	20.3226	19.6404	19.0535 (87)
Th 2	20.1059	20.1079	20.1099	20.1190	20.1207	20.1286	20.1286	20.1301	20.1256	20.1207	20.1172	20.1136 (88)
util rest of house	0.9348	0.9042	0.8539	0.7486	0.5993	0.4257	0.2942	0.3350	0.5521	0.7900	0.9020	0.9414 (89)
MIT 2	17.8884	18.2610	18.7762	19.4110	19.8423	20.0593	20.1128	20.1061	19.9691	19.4136	18.5753	17.8327 (90)
Living area fraction									fLA = Living area / (4) =			0.5440 (91)
MIT	18.5484	18.8802	19.3405	19.9132	20.3143	20.5230	20.5805	20.5711	20.4297	19.9081	19.1547	18.4968 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5484	18.8802	19.3405	19.9132	20.3143	20.5230	20.5805	20.5711	20.4297	19.9081	19.1547	18.4968 (93)

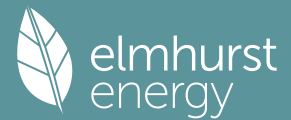
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9178	0.8859	0.8373	0.7416	0.6090	0.4518	0.3297	0.3714	0.5730	0.7821	0.8850	0.9251 (94)
Useful gains	616.8906	681.5824	710.2514	708.3134	627.4950	464.6849	323.3823	335.0181	469.8563	565.0020	586.2200	595.9771 (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	1219.9342	1194.0649	1094.1181	927.8940	724.2399	493.0441	331.3462	346.5690	528.9275	782.5711	1017.8496	1212.5634 (97)
Space heating kWh	448.6645	344.3883	285.5968	158.0980	71.9781	0.0000	0.0000	0.0000	0.0000	161.8714	310.7733	458.7402 (98a)
Space heating requirement - total per year (kWh/year)												2240.1106
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	448.6645	344.3883	285.5968	158.0980	71.9781	0.0000	0.0000	0.0000	0.0000	161.8714	310.7733	458.7402 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2240.1106
Space heating per m2										(98c) / (4) =		25.4558 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	448.6645	344.3883	285.5968	158.0980	71.9781	0.0000	0.0000	0.0000	0.0000	161.8714	310.7733	458.7402 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	486.0937	373.1184	309.4224	171.2871	77.9828	0.0000	0.0000	0.0000	0.0000	175.3753	336.6991	497.0100 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	236.5474	209.1356	222.3036	196.0568	190.3894	171.9490	170.1193	176.7433	178.5083	198.5512	210.4588	234.0713 (64)
Efficiency of water heater	85.4722	85.1707	84.6227	83.5816	82.0823	79.8000	79.8000	79.8000	79.8000	83.6056	84.9323	79.8000 (216)
Fuel for water heating, kWh/month	276.7537	245.5488	262.6996	234.5693	231.9495	215.4749	213.1821	221.4828	223.6946	237.4856	247.7959	273.6379 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.9642	20.0272	18.0323	13.2112	10.2047	8.3374	9.3091	12.1003	15.7171	20.6217	23.2922	25.6581 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-19.3319	-28.8994	-44.0134	-52.5226	-59.3123	-56.3327	-55.6341	-51.1801	-43.8176	-34.3449	-21.8253	-16.5265 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-6.4380	-13.8870	-28.2591	-43.4331	-58.4202	-59.0763	-58.3944	-48.9953	-35.3223	-20.1918	-8.6993	-5.0666 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												2426.9888 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2884.2747 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	201.4757 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-869.9241 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4728.8151 (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	2426.9888	0.2100	509.6676 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2884.2747	0.2100	605.6977 (264)
Space and water heating			1115.3653 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	201.4757	0.1443	29.0792 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.7408	0.1334	-64.5226
PV Unit electricity exported	-386.1833	0.1252	-48.3583
Total			-112.8809 (269)
Total CO2, kg/year			1043.4928 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			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	2426.9888	1.1300	2742.4973 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2884.2747	1.1300	3259.2305 (278)
Space and water heating			6001.7278 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	201.4757	1.5338	309.0302 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-483.7408	1.4929	-722.1722
PV Unit electricity exported	-386.1833	0.4596	-177.4956
Total			-899.6678 (283)
Total Primary energy kWh/year			5541.1910 (286)
Target Primary Energy Rate (TPER)			62.9700 (287)

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Property Reference	Flat 201 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 201 WCS - Green	Prop Type Ref		Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	84 B	DER	3.07	TER	13.79	
Environmental	98 A	% DER < TER				77.74
CO ₂ Emissions (t/year)	0.17	DFEE	33.41	TFEE	32.59	
Compliance Check	See BREL	% DFEE < TFEE				-2.50
% DPER < TPER	55.60	DPER	32.68	TPER	73.62	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0000 (1b)	x 2.5200 (2b)	= 153.7200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.7200 (5)

2. Ventilation rate

	m ³ 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)

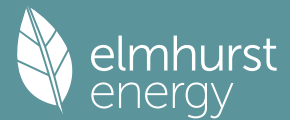
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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				12.6000	0.0900	1.1340	
E16 Corner (normal)				5.0400	-0.0900	-0.4536	
E17 Corner (inverted - internal area greater than external area)				10.2600	0.0500	0.5130	
E1 Steel lintel with perforated steel base plate				9.3100	0.0500	0.4655	
E3 Sill				31.8000	0.0500	1.5900	
E4 Jamb				63.6600	0.0700	4.4562	
E7 Party floor between dwellings (in blocks of flats)				2.5200	0.0600	0.1512	
E18 Party wall between dwellings				6.7400	0.4430	2.9858	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation				7.1200	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)							10.8421 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							(36a) = 0.0000
Point Thermal bridges							(33) + (36) + (36a) = 40.5723 (37)
Total fabric heat loss							

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

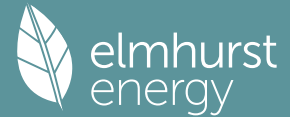
4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Hot water usage for mixer showers												2.0098 (42)
Hot water usage for baths	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 other uses	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)
Average daily hot water use (litres/day)	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)
												108.6142 (43)
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)												1804.0599
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (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	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (64)
Total per year (kWh/year) = Sum(64)m =												2542.0169 (64)
12Total per year (kWh/year)												2542 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	112.3625	100.0389	107.6650	97.6326	96.7354	89.4153	89.7304	91.9323	91.4652	99.3292	102.4129	111.4958 (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												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	151.0248	148.8674	144.7110	135.6008	130.0207	124.1880	120.6053	123.5650	127.0350	133.5070	142.2402	149.8600 (72)
	468.1333	477.2788	459.0520	443.1240	422.2639	407.7927	393.5181	394.6571	405.6653	418.9551	442.9683	459.2266 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	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	608.8208	722.6637	810.0503	903.5925	961.3611	953.2554	915.1310	856.0402	794.3271	694.2700	612.5252	578.9492 (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, n _l (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	0.8727	0.8104	0.7289	0.6019	0.4642	0.3295	0.2389	0.2655	0.4197	0.6494	0.8136	0.8853 (86)
MIT	19.7305	20.0607	20.3992	20.7240	20.9001	20.9755	20.9935	20.9908	20.9458	20.7053	20.1965	19.6725 (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	0.8597	0.7931	0.7063	0.5732	0.4304	0.2919	0.1981	0.2224	0.3771	0.6159	0.7938	0.8733 (89)
MIT 2	18.7399	19.1426	19.5499	19.9351	20.1301	20.2158	20.2312	20.2314	20.1856	19.9253	19.3242	18.6749 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.3654 (91)
MIT	19.1018	19.4781	19.8603	20.2233	20.4115	20.4934	20.5098	20.5089	20.4634	20.2104	19.6430	19.0395 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1018	19.4781	19.8603	20.2233	20.4115	20.4934	20.5098	20.5089	20.4634	20.2104	19.6430	19.0395 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8388	0.7755	0.6956	0.5732	0.4387	0.3047	0.2128	0.2379	0.3902	0.6153	0.7776	0.8525 (94)
Ext temp.	510.6613	560.4253	563.4817	517.9664	421.7327	290.4419	194.7291	203.6145	309.9173	427.1715	476.2818	493.5463 (95)
Heat loss rate W	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)
Space heating kWh	769.6528	755.8687	690.7558	577.0960	442.6987	295.1445	195.8034	205.1707	320.5590	488.3764	641.1039	762.8585 (97)
Space heating requirement - total per year (kWh/year)	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98a)
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)
Space heating requirement after solar contribution - total per year (kWh/year)	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98c)
Space heating per m2	(98c) / (4) =											13.7946 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682

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Space heating requirement	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027
Water heating fuel	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.8254	12.4875	13.8254	13.3795	13.8254	13.3795	13.8254	13.8254	13.3795	13.8254	13.3795	13.8254 (331)
Lighting	17.0777	13.7004	12.3357	9.0376	6.9809	5.7035	6.3682	8.2777	10.7519	14.1070	15.9339	17.5523 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												841.4682 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2542.0169 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												8.4147 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)												162.7833 (330a)
Total electricity for the above, kWh/year												162.7833 (331)
Electricity for lighting (calculated in Appendix L)												137.8268 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3684.0952 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	966.7100	0.1567	37.6657 (367)
Electrical energy for heat distribution (space & water)	8.4147	0.0000	4.8961 (372)
Overall CO2 factor for heat network			0.0428 (386)
Total CO2 associated with community systems			144.7844 (373)
Space and water heating			144.7844 (376)
Pumps, fans and electric keep-hot	162.7833	0.1387	22.5801 (378)
Energy for lighting	137.8268	0.1443	19.8927 (379)
Total CO2, kg/year			187.2571 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.0700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	966.7100	1.5800	379.8537 (467)
Electrical energy for heat distribution (space & water)	8.4147	0.0000	51.9442 (472)
Overall CO2 factor for heat network			0.4540 (486)
Total CO2 associated with community systems			1536.0651 (473)
Space and water heating			1536.0651 (476)
Pumps, fans and electric keep-hot	162.7833	1.5128	246.2586 (478)
Energy for lighting	137.8268	1.5338	211.4034 (479)
Total Primary energy kWh/year			1993.7271 (483)
Dwelling Primary energy Rate (DPER)			32.6800 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

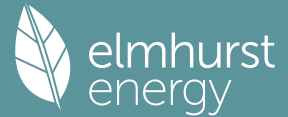
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	12.6000	0.0900	1.1340
E17 Corner (inverted - internal area greater than external area)	5.0400	-0.0900	-0.4536
E1 Steel lintel with perforated steel base plate	10.2600	0.0500	0.5130
E3 Sill	9.3100	0.0500	0.4655
E4 Jamb	31.8000	0.0500	1.5900
E7 Party 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

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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												147.9356 162.0744 184.5269 (45)
Energy content (annual)												Total = Sum(45)m = 1804.0599
Distribution loss (46)m = 0.15 x (45)m												
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage												
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss												23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 (59)
Combi loss												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month												
	235.6854	208.5168	221.5575	194.6832	188.6866	169.9697	167.6188	174.2414	176.1348	196.4876	209.0602	233.0789 (62)
WWHRS												-26.4771 -23.4166 -24.5205 -20.3039 -18.9225 -16.1921 -15.1775 -16.1398 -16.7530 -19.7500 -22.3743 -25.9868 (63a)
PV diverter												-0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h												
	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921 (64)
												Total per year (kWh/year) = Sum(64)m = 2129.7068 (64)
12Total per year (kWh/year)												2130 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
	101.0635	89.8333	96.3659	86.6980	85.4364	78.4808	78.4313	80.6333	80.5307	88.0302	91.4784	100.1968 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	88.5730	98.0630	88.5730	91.5254	88.5730	91.5254	88.5730	88.5730	91.5254	88.5730	91.5254	88.5730 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488 (69)
Pumps, fans												3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905 (71)
Water heating gains (Table 5)												
	135.8380	133.6805	129.5241	120.4139	114.8338	109.0011	105.4185	108.3781	111.8482	118.3202	127.0533	134.6731 (72)
Total internal gains												456.0192 465.1724 446.9378 431.0123 410.1497 392.6809 378.4040 379.5429 390.5536 406.8409 430.8566 447.1125 (73)

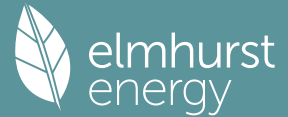
6. Solar gains												

[Jan]												
	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast	5.9000		36.7938		0.6300		0.7000		0.7700		66.3436 (77)	
Southwest	3.2000		36.7938		0.6300		0.7000		0.7700		35.9830 (79)	
Northwest	4.1500		11.2829		0.6300		0.7000		0.7700		14.3101 (81)	

Solar gains	116.6366	203.4285	290.9652	381.6822	446.8317	452.0968	432.3338	382.4304	322.1768	228.2360	140.5694	99.2565 (83)
Total gains	572.6558	668.6009	737.9031	812.6945	856.9814	844.7778	810.7378	761.9733	712.7305	635.0770	571.4260	546.3690 (84)

7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.9193	0.8808	0.8267	0.7298	0.6019	0.4537	0.3377	0.3717	0.5528	0.7645	0.8821	0.9275 (86)
MIT	19.1353	19.4736	19.8904	20.3715	20.7166	20.9093	20.9713	20.9616	20.8342	20.3838	19.6927	19.0734 (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	0.9085	0.8657	0.8050	0.6975	0.5563	0.3942	0.2679	0.2995	0.4918	0.7284	0.8646	0.9176 (89)
MIT 2	17.8695	18.2882	18.7997	19.3779	19.7680	19.9714	20.0242	20.0191	19.9024	19.4089	18.5744	17.7974 (90)
Living area fraction	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	fLA = Living area / (4) =			0.3654 (91)
MIT	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	20.2429	19.7651	18.9830	18.2637 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	20.2429	19.7651	18.9830	18.2637 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8850	0.8417	0.7843	0.6870	0.5604	0.4117	0.2923	0.3242	0.5054	0.7174	0.8419	0.8949 (94)
Useful gains	506.8193	562.7864	578.7269	558.3296	480.2600	347.7898	236.9796	247.0540	360.2323	455.6144	481.0806	488.9702 (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	923.2749	907.4914	832.0190	703.3905	544.9582	366.8782	242.0761	254.0717	395.7263	593.5624	772.4563	917.7721 (97)
Space heating kWh	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98a)
Space heating requirement - total per year (kWh/year)												1513.9658
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	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1513.9658
Space heating per m2										(98c) / (4) =		24.8191 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	335.6912	250.9661	204.1705	113.1569	52.1511	0.0000	0.0000	0.0000	0.0000	111.1954	227.2919	345.6432 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921 (64)
Efficiency of water heater	84.9389	84.5639	83.9599	82.9492	81.6276	79.8000	79.8000	79.8000	79.8000	82.8862	84.3221	79.8000 (216)
Fuel for water heating, kWh/month	246.3045	218.8879	234.6798	210.2242	207.9739	192.7037	191.0292	198.1223	199.7265	213.2294	221.3962	243.5649 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)	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)	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												

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Space heating fuel - main system 1	1640.2663 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2577.8427 (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	3849.6220 (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	1640.2663	0.2100	344.4559 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2577.8427	0.2100	541.3470 (264)
Space and water heating			885.8029 (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			840.8912 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7900 (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	1640.2663	1.1300	1853.5009 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2577.8427	1.1300	2912.9622 (278)
Space and water heating			4766.4632 (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			4490.9779 (286)
Target Primary Energy Rate (TPER)			73.6200 (287)

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Property Reference	Flat 202 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 202 VL - Be Green	Prop Type Ref		Flat 203 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	84 B	DER	3.23	TER	14.90	
Environmental	98 A	% DER < TER				78.32
CO ₂ Emissions (t/year)	0.15	DFEE	31.35	TFEE	32.01	
Compliance Check	See BREL	% DFEE < TFEE				2.06
% DPER < TPER	56.93	DPER	34.52	TPER	80.14	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.5800 (2b)	= 133.2054 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.2054 (5)

2. Ventilation rate

	m ³ 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)

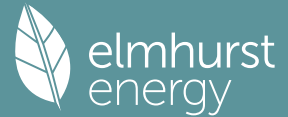
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
K1 Element	Length	Psi-value	Total				
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
													34.8395
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

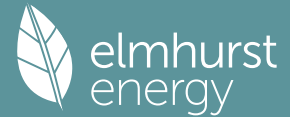
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7382 (42)
Hot water usage for mixer showers													
Hot water usage for baths	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 other uses	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)
Average daily hot water use (litres/day)	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)
													100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
Primary loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	107.4683	95.7325	103.1405	93.7699	93.0706	86.1991	86.6165	88.6452	88.0875	95.4602	98.1741	106.6698	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734 (72)
	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northwest			1.9800		11.2829		0.4700		0.7000		0.7700		5.0935 (81)	
Northeast			11.2800		11.2829		0.4700		0.7000		0.7700		29.0175 (75)	
Solar gains			34.1110	69.4340	125.0980	205.4469	276.1609	294.4167	275.4208	219.5687	152.4339	84.8539	42.9205	27.8568 (83)
Total gains			455.4932	498.5858	538.2743	604.3441	656.7266	662.1514	630.6248	575.9277	518.4973	462.7655	442.0688	441.4827 (84)

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, n _{l1} , 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	0.8771	0.8372	0.7684	0.6305	0.4737	0.3263	0.2372	0.2700	0.4439	0.6824	0.8239	0.8851 (86)
MIT	20.0677	20.2621	20.5215	20.8059	20.9429	20.9895	20.9976	20.9961	20.9670	20.7835	20.4201	20.0463 (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	0.8656	0.8229	0.7494	0.6055	0.4446	0.2954	0.2038	0.2340	0.4066	0.6534	0.8066	0.8743 (89)
MIT 2	19.2604	19.4998	19.8152	20.1566	20.3094	20.3672	20.3743	20.3754	20.3427	20.1399	19.7061	19.2409 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.6328 (91)
MIT	19.7713	19.9822	20.2621	20.5674	20.7102	20.7610	20.7687	20.7682	20.7377	20.5472	20.1579	19.7505 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7713	19.9822	20.2621	20.5674	20.7102	20.7610	20.7687	20.7682	20.7377	20.5472	20.1579	19.7505 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8544	0.8142	0.7466	0.6137	0.4605	0.3145	0.2248	0.2566	0.4285	0.6620	0.8008	0.8630 (94)
Ext temp.	389.1543	405.9476	401.9005	370.8619	302.4396	208.2527	141.7821	147.7780	222.1600	306.3416	354.0175	380.9840 (95)
Heat loss rate W	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)
Space heating kWh	553.3412	537.4983	488.6961	406.8609	313.0494	210.1189	142.1734	148.4189	228.0759	345.6020	457.0167	548.2289 (97)
Space heating requirement - total per year (kWh/year)	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302 (98a)
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)
Space heating contribution - total per year (kWh/year)	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302 (98c)
Space heating per m2	(98c) / (4) =											10.3960 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302
Space heating requirement	122.1550	88.4021	64.5759	25.9192	7.8937	0.0000	0.0000	0.0000	0.0000	29.2097	74.1594	124.4302 (307)

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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating													
Annual water heating requirement	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	
Water heating fuel													
	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(310)
Cooling System Energy Efficiency Ratio													0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.6919	12.3668	13.6919	13.2502	13.6919	13.2502	13.6919	13.6919	13.2502	13.6919	13.2502	13.6919	13.6919 (331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year													
Space heating fuel - community heating													536.7452 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2400.1181 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													5.3675 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)													
mechanical ventilation fans (SFP = 0.9920)													161.2105 (330a)
Total electricity for the above, kWh/year													161.2105 (331)
Electricity for lighting (calculated in Appendix L)													135.8500 (332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (333)
Wind generation													0.0000 (334)
Hydro-electric generation (Appendix N)													0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (335)
Appendix Q - special features													
Energy saved or generated													-0.0000 (336)
Energy used													0.0000 (337)
Total delivered energy for all uses													3233.9238 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	839.1038	0.1568	24.0391	(367)
Electrical energy for heat distribution (space & water)	5.3675	0.0000	4.2183	(372)
Overall CO2 factor for heat network			0.0425	(386)
Total CO2 associated with community systems			124.7400	(373)
Space and water heating			124.7400	(376)
Pumps, fans and electric keep-hot	161.2105	0.1387	22.3619	(378)
Energy for lighting	135.8500	0.1443	19.6074	(379)
Total CO2, kg/year			166.7093	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2300	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	839.1038	1.5803	242.3497	(467)
Electrical energy for heat distribution (space & water)	5.3675	0.0000	44.9697	(472)
Overall CO2 factor for heat network			0.4528	(486)
Total CO2 associated with community systems			1329.8185	(473)
Space and water heating			1329.8185	(476)
Pumps, fans and electric keep-hot	161.2105	1.5128	243.8792	(478)
Energy for lighting	135.8500	1.5338	208.3713	(479)
Total Primary energy kWh/year			1782.0691	(483)
Dwelling Primary energy Rate (DPER)			34.5200	(484)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.5800 (2b)	= 133.2054 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.2054 (5)

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							109.3926 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												50.0075
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7382 (42)
Hot water usage for mixer showers	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	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)
Water storage loss:												1662.1611
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019 (46)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645 (62)
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
12Total per year (kWh/year)												2007.1523 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708 (65)

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	3.0000	3.0000	3.0000	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)	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865 (72)
Total internal gains	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651 (73)

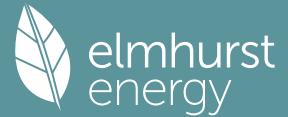
6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			9.3800	11.2829	0.6300	0.7000	0.7700	32.3442 (75)				
Northwest			1.6500	11.2829	0.6300	0.7000	0.7700	5.6896 (81)				
Solar gains	38.0338	77.4189	139.4842	229.0732	307.9193	328.2745	307.0941	244.8190	169.9637	94.6120	47.8564	31.0603 (83)
Total gains	447.3552	494.5234	540.5997	615.9138	676.4242	680.9526	647.2374	586.1173	520.9705	460.4629	434.9481	432.6254 (84)

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, nil,m (see Table 9a)	

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	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	0.9280	0.9024	0.8550	0.7489	0.6007	0.4402	0.3281	0.3742	0.5824	0.7990	0.8973	0.9336 (86)
MIT	19.2824	19.5332	19.9241	20.4281	20.7706	20.9357	20.9807	20.9709	20.8462	20.3994	19.7827	19.2463 (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	0.9184	0.8898	0.8365	0.7189	0.5579	0.3860	0.2652	0.3070	0.5244	0.7671	0.8820	0.9248 (89)
MIT 2	18.1031	18.4162	18.8996	19.5089	19.8954	20.0709	20.1093	20.1045	19.9888	19.4922	18.7398	18.0635 (90)
Living area fraction	18.8493	19.1230	19.5479	20.0906	20.4492	20.6181	20.6607	20.6527	20.5314	20.0662	19.3997	18.8119 (92)
MIT	18.8493	19.1230	19.5479	20.0906	20.4492	20.6181	20.6607	20.6527	20.5314	20.0662	19.3997	18.8119 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8493	19.1230	19.5479	20.0906	20.4492	20.6181	20.6607	20.6527	20.5314	20.0662	19.3997	18.8119 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9024	0.8739	0.8237	0.7183	0.5746	0.4171	0.3041	0.3480	0.5524	0.7654	0.8679	0.9092 (94)
Useful gains	403.7150	432.1664	445.2996	442.3853	388.6783	284.0221	196.8258	203.9923	287.8072	352.4311	377.5022	393.3472 (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	740.3649	721.8638	660.5149	559.6186	436.5245	297.0429	200.4281	209.4850	318.7655	472.3001	616.5323	735.9834 (97)
Space heating kWh	250.4675	194.6766	160.1202	84.4079	35.5976	0.0000	0.0000	0.0000	0.0000	89.1826	172.1017	254.9214 (98a)
Space heating requirement - total per year (kWh/year)												1241.4756
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	250.4675	194.6766	160.1202	84.4079	35.5976	0.0000	0.0000	0.0000	0.0000	89.1826	172.1017	254.9214 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1241.4756
Space heating per m2										(98c) / (4) =		24.0456 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	250.4675	194.6766	160.1202	84.4079	35.5976	0.0000	0.0000	0.0000	0.0000	89.1826	172.1017	254.9214 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	271.3624	210.9173	173.4780	91.4495	38.5673	0.0000	0.0000	0.0000	0.0000	96.6225	186.4591	276.1878 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
Efficiency of water heater (217)m	84.6043	84.3123	83.7333	82.6420	81.2978	79.8000	79.8000	79.8000	79.8000	82.7226	84.0134	79.8000 (216)
Fuel for water heating, kWh/month	232.3415	206.3635	221.3668	198.8806	197.0902	182.1778	180.7890	187.3239	188.6473	201.4617	209.1296	229.8692 (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	7.0685	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												1345.0440 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	79.8000
Water heating fuel used	2435.4412 (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	3569.4839 (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	1345.0440	0.2100	282.4592 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2435.4412	0.2100	511.4426 (264)
Space and water heating			793.9019 (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			769.0962 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.9000 (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	1345.0440	1.1300	1519.8997 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2435.4412	1.1300	2752.0485 (278)
Space and water heating			4271.9482 (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			4137.3971 (286)
Target Primary Energy Rate (TPER)			80.1400 (287)

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Property Reference	Flat 202 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 202 WCS - Green		Prop Type Ref	Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	84 B	DER	3.20	TER	14.53	
Environmental	98 A	% DER < TER				77.98
CO ₂ Emissions (t/year)	0.15	DFEE	31.94	TFEE	31.43	
Compliance Check	See BREL	% DFEE < TFEE				-1.62
% DPER < TPER	56.13	DPER	34.13	TPER	77.79	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.0000 (1b)	x 2.5200 (2b)	= 131.0400 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 131.0400 (5)

2. Ventilation rate

	m ³ 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)

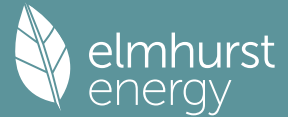
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
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				
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												41.8346	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
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													
Hot water usage for baths	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 other uses	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)
Average daily hot water use (litres/day)	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)
												100.4145	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
Primary loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
12Total per year (kWh/year)													
Electric shower(s)													2405.8210 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341 (72)
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast				12.4200	36.7938	0.4700	0.7000		0.7700		104.1899 (77)	
Southeast				2.0500	36.7938	0.4700	0.7000		0.7700		17.1972 (77)	
Southwest				2.0500	36.7938	0.4700	0.7000		0.7700		17.1972 (79)	
Solar gains	138.5844	236.0604	322.9882	400.1980	448.2551	445.0136	429.0406	393.1878	349.7279	260.8971	165.9921	118.5993 (83)
Total gains	561.8387	667.1394	738.0015	800.8662	830.4905	814.3523	785.7788	751.0805	717.3771	640.4523	566.8952	534.0513 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,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	0.8443	0.7732	0.6902	0.5714	0.4457	0.3178	0.2288	0.2491	0.3859	0.6018	0.7754	0.8589 (86)
MIT	19.9248	20.2345	20.5195	20.7787	20.9183	20.9802	20.9950	20.9933	20.9613	20.7797	20.3494	19.8689 (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	0.8297	0.7547	0.6672	0.5437	0.4137	0.2825	0.1909	0.2099	0.3473	0.5692	0.7542	0.8454 (89)
MIT 2	18.9961	19.3706	19.7111	20.0186	20.1735	20.2457	20.2584	20.2593	20.2248	20.0286	19.5254	18.9346 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.5987	19.9311	20.2356	20.5118	20.6567	20.7223	20.7363	20.7355	20.7027	20.5160	20.0601	19.5408 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.5987	19.9311	20.2356	20.5118	20.6567	20.7223	20.7363	20.7355	20.7027	20.5160	20.0601	19.5408 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8165	0.7469	0.6672	0.5535	0.4312	0.3046	0.2153	0.2350	0.3706	0.5809	0.7486	0.8316 (94)
Ext temp.	458.7391	498.2648	492.3657	443.3178	358.0685	248.0341	169.1879	176.5282	265.8613	372.0702	424.3591	444.1029 (95)
Heat loss rate W	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)
Space heating kwh	653.9541	640.6283	583.6882	486.1389	373.8579	251.6997	170.0521	177.6971	273.1082	413.8959	544.2148	648.0438 (97)
Space heating requirement - total per year (kWh/year)	145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321 (98a)
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)	145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321 (98c)
Space heating per m2	(98c) / (4) =											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)											
Fraction of space heat from community system	1.0000 (302)											
Fraction of heat from community Heat pump-Space and Water	1.0000 (303a)											
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)											
Factor for charging method (Table 4c(3)) for water heating	1.0000 (305a)											
Distribution loss factor (Table 12c) for community heating system	1.0000 (306)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating:												
Space heating requirement	145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321
Space heating requirement												

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145.2400	95.6682	67.9439	30.8312	11.7473	0.0000	0.0000	0.0000	0.0000	31.1183	86.2961	151.7321	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating												
Annual water heating requirement												
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel												
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(310)
Cooling System Energy Efficiency Ratio												
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	11.7856	10.6451	11.7856	11.4054	11.7856	11.4054	11.7856	11.4054	11.7856	11.4054	11.7856	(331)
Lighting	15.5992	12.5143	11.2677	8.2552	6.3766	5.2097	5.8169	7.5610	9.8210	12.8857	14.5544	(332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year												
Space heating fuel - community heating												620.5771 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												6.2058 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)												138.7661 (330a)
Total electricity for the above, kWh/year												138.7661 (331)
Electricity for lighting (calculated in Appendix L)												125.8946 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3291.0588 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	864.6852	0.1568	27.8089 (367)
Electrical energy for heat distribution (space & water)	6.2058	0.0000	4.3583 (372)
Overall CO2 factor for heat network			0.0426 (386)
Total CO2 associated with community systems			128.8805 (373)
Space and water heating			128.8805 (376)
Pumps, fans and electric keep-hot	138.7661	0.1387	19.2486 (378)
Energy for lighting	125.8946	0.1443	18.1705 (379)
Total CO2, kg/year			166.2996 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	864.6852	1.5806	280.2513 (467)
Electrical energy for heat distribution (space & water)	6.2058	0.0000	46.3831 (472)
Overall CO2 factor for heat network			0.4532 (486)
Total CO2 associated with community systems			1371.6160 (473)
Space and water heating			1371.6160 (476)
Pumps, fans and electric keep-hot	138.7661	1.5128	209.9254 (478)
Energy for lighting	125.8946	1.5338	193.1013 (479)
Total Primary energy kWh/year			1774.6427 (483)
Dwelling Primary energy Rate (DPER)			34.1300 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							107.8775 (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	
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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												54.6509
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541 (44)
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												1667.8640
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
												2012.0777 (64)
12Total per year (kWh/year)												2012 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0499	85.3052	77.0499	79.6182	77.0499	79.6182	77.0499	77.0499	79.6182	77.0499	79.6182	77.0499 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472 (72)
Total internal gains	411.2360	419.0786	402.9950	388.6554	370.2170	354.3259	341.7199	342.8743	352.6365	367.5369	388.8904	403.4336 (73)

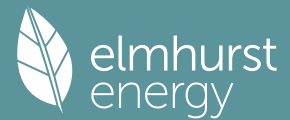
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				9.6400	36.7938	0.6300	0.7000	0.7700	108.3987 (77)			
Southwest				1.3700	36.7938	0.6300	0.7000	0.7700	15.4052 (79)			
Solar gains	123.8039	210.8838	288.5404	357.5155	400.4472	397.5513	383.2819	351.2530	312.4282	233.0715	148.2885	105.9503 (83)
Total gains	535.0399	629.9624	691.5353	746.1710	770.6642	751.8773	725.0018	694.1273	665.0647	600.6084	537.1788	509.3839 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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Utilisation factor for gains for living area, nil,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	0.9010	0.8540	0.7941	0.6972	0.5752	0.4328	0.3192	0.3457	0.5111	0.7222	0.8557	0.9109 (86)
MIT	19.2864	19.6368	20.0279	20.4540	20.7524	20.9214	20.9759	20.9690	20.8675	20.4832	19.8333	19.2228 (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	0.8883	0.8367	0.7705	0.6640	0.5304	0.3758	0.2535	0.2786	0.4527	0.6843	0.8357	0.8994 (89)
MIT 2	18.0617	18.4921	18.9680	19.4777	19.8131	19.9922	20.0383	20.0352	19.9416	19.5258	18.7501	17.9888 (90)
Living area fraction									fLA =	Living area / (4) =		0.6488 (91)
MIT	18.8563	19.2349	19.6557	20.1111	20.4226	20.5951	20.6466	20.6411	20.5424	20.1470	19.4530	18.7895 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8563	19.2349	19.6557	20.1111	20.4226	20.5951	20.6466	20.6411	20.5424	20.1470	19.4530	18.7895 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8703	0.8207	0.7605	0.6665	0.5487	0.4089	0.2950	0.3207	0.4837	0.6886	0.8219	0.8815 (94)
Useful gains	465.6539	516.9918	525.9303	497.3535	422.8337	307.4673	213.9110	222.6004	321.6802	413.6079	441.5143	449.0284 (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	808.2618	794.0584	727.0281	612.7043	475.7018	323.7625	218.5350	228.6168	349.2360	520.6659	676.5546	802.5782 (97)
Space heating kWh	254.9003	186.1887	149.6168	83.0526	39.3338	0.0000	0.0000	0.0000	0.0000	79.6512	169.2290	263.0410 (98a)
Space heating requirement - total per year (kWh/year)												1225.0134
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	254.9003	186.1887	149.6168	83.0526	39.3338	0.0000	0.0000	0.0000	0.0000	79.6512	169.2290	263.0410 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1225.0134
Space heating per m2										(98c) / (4) =		23.5580 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	254.9003	186.1887	149.6168	83.0526	39.3338	0.0000	0.0000	0.0000	0.0000	79.6512	169.2290	263.0410 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	276.1650	201.7213	162.0984	89.9811	42.6152	0.0000	0.0000	0.0000	0.0000	86.2960	183.3467	284.9848 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	84.6378	84.2063	83.5782	82.6059	81.4234	79.8000	79.8000	79.8000	79.8000	82.4995	83.9701	79.8000 (216)
Fuel for water heating, kWh/month	232.8496	207.1537	222.3392	199.4551	197.2568	182.6008	181.2006	187.7579	189.0926	202.4977	209.7634	230.2864 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)	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)	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												1327.2085 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2442.2538 (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	3470.6215 (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	1327.2085	0.2100	278.7138 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2442.2538	0.2100	512.8733 (264)
Space and water heating			791.5871 (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			755.4260 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5300 (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	1327.2085	1.1300	1499.7456 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2442.2538	1.1300	2759.7468 (278)
Space and water heating			4259.4923 (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			4045.0070 (286)
Target Primary Energy Rate (TPER)			77.7900 (287)

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Property Reference	Flat 203 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 203 VL - Be Green		Prop Type Ref	Flat 203 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	84 B	DER	3.21	TER	14.73	
Environmental	98 A	% DER < TER				78.21
CO ₂ Emissions (t/year)	0.15	DFEE	30.64	TFEE	31.23	
Compliance Check	See BREL	% DFEE < TFEE				1.91
% DPER < TPER	56.72	DPER	34.30	TPER	79.25	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.5800 (2b)	= 133.2054 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.2054 (5)

2. Ventilation rate

	m ³ 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)

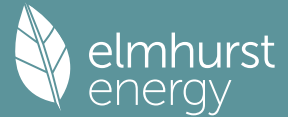
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
K1 Element	Length	Psi-value	Total				
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
													34.8395
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

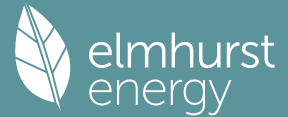
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7382 (42)
Hot water usage for mixer showers													
Hot water usage for baths	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 other uses	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)
Average daily hot water use (litres/day)	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)
													100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019	(46)
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
Primary loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2400.1181 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	107.4683	95.7325	103.1405	93.7699	93.0706	86.1991	86.6165	88.6452	88.0875	95.4602	98.1741	106.6698	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734 (72)
	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast			1.9800		36.7938		0.4700		0.7000		0.7700		16.6100 (77)	
Northeast			11.2800		11.2829		0.4700		0.7000		0.7700		29.0175 (75)	
Solar gains			45.6275	87.3590	145.1299	222.7349	288.6497	303.7910	285.7172	233.9078	171.5888	103.4531	56.4065	37.9119 (83)
Total gains			467.0097	516.5108	558.3061	621.6321	669.2154	671.5257	640.9212	590.2669	537.6522	481.3648	455.5548	451.5377 (84)

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, nil,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	0.8700	0.8250	0.7533	0.6175	0.4658	0.3219	0.2334	0.2635	0.4294	0.6643	0.8130	0.8790 (86)
MIT	20.0996	20.3032	20.5543	20.8190	20.9459	20.9900	20.9977	20.9965	20.9705	20.8025	20.4492	20.0752 (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	0.8580	0.8101	0.7338	0.5924	0.4370	0.2913	0.2006	0.2283	0.3930	0.6352	0.7952	0.8677 (89)
MIT 2	19.2993	19.5491	19.8535	20.1710	20.3125	20.3676	20.3743	20.3756	20.3458	20.1605	19.7405	19.2763 (90)
Living area fraction	19.8057	20.0263	20.2970	20.5811	20.7133	20.7614	20.7688	20.7685	20.7411	20.5668	20.1890	19.7818 (92)
MIT	19.8057	20.0263	20.2970	20.5811	20.7133	20.7614	20.7688	20.7685	20.7411	20.5668	20.1890	19.7818 (93)
Temperature adjustment												0.0000
adjusted MIT	19.8057	20.0263	20.2970	20.5811	20.7133	20.7614	20.7688	20.7685	20.7411	20.5668	20.1890	19.7818 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8471	0.8022	0.7321	0.6011	0.4529	0.3103	0.2213	0.2505	0.4146	0.6447	0.7901	0.8566 (94)
Ext temp.	395.6002	414.3320	408.7360	373.6931	303.1120	208.3532	141.8075	147.8395	222.8915	310.3279	359.9400	386.8000 (95)
Heat loss rate W	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)
Space heating kWh	554.5732	539.0699	489.9335	407.3363	313.1563	210.1343	142.1773	148.4283	228.1902	346.2821	458.1041	549.3313 (97)
Space heating requirement - total per year (kWh/year)	118.2759	83.8239	60.4110	24.2232	7.4729	0.0000	0.0000	0.0000	0.0000	26.7499	70.6782	120.9233 (98a)
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)	118.2759	83.8239	60.4110	24.2232	7.4729	0.0000	0.0000	0.0000	0.0000	26.7499	70.6782	120.9233 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												512.5582
Space heating per m2												(98c) / (4) = 9.9275 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	118.2759	83.8239	60.4110	24.2232	7.4729	0.0000	0.0000	0.0000	0.0000	26.7499	70.6782	120.9233 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	118.2759	83.8239	60.4110	24.2232	7.4729	0.0000	0.0000	0.0000	0.0000	26.7499	70.6782	120.9233
Space heating requirement	118.2759	83.8239	60.4110	24.2232	7.4729	0.0000	0.0000	0.0000	0.0000	26.7499	70.6782	120.9233 (307)

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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating													
Annual water heating requirement	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	
Water heating fuel	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	13.6919	12.3668	13.6919	13.2502	13.6919	13.2502	13.6919	13.6919	13.2502	13.6919	13.2502	13.6919	(331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating													512.5582 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2400.1181 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													5.1256 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)													
mechanical ventilation fans (SFP = 0.9920)													161.2105 (330a)
Total electricity for the above, kWh/year													161.2105 (331)
Electricity for lighting (calculated in Appendix L)													135.8500 (332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (333)
Wind generation													0.0000 (334)
Hydro-electric generation (Appendix N)													0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (335)
Appendix Q - special features													
Energy saved or generated													-0.0000 (336)
Energy used													0.0000 (337)
Total delivered energy for all uses													3209.7367 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	832.1932	0.1569	22.9728	(367)
Electrical energy for heat distribution (space & water)	5.1256	0.0000	4.1809	(372)
Overall CO2 factor for heat network			0.0424	(386)
Total CO2 associated with community systems			123.6364	(373)
Space and water heating			123.6364	(376)
Pumps, fans and electric keep-hot	161.2105	0.1387	22.3619	(378)
Energy for lighting	135.8500	0.1443	19.6074	(379)
Total CO2, kg/year			165.6057	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2100	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	832.1932	1.5807	231.4905	(467)
Electrical energy for heat distribution (space & water)	5.1256	0.0000	44.5896	(472)
Overall CO2 factor for heat network			0.4527	(486)
Total CO2 associated with community systems			1318.5793	(473)
Space and water heating			1318.5793	(476)
Pumps, fans and electric keep-hot	161.2105	1.5128	243.8792	(478)
Energy for lighting	135.8500	1.5338	208.3713	(479)
Total Primary energy kWh/year			1770.8298	(483)
Dwelling Primary energy Rate (DPER)			34.3000	(484)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.5800 (2b)	= 133.2054 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.2054 (5)

2. Ventilation rate

	m ³ 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)
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)

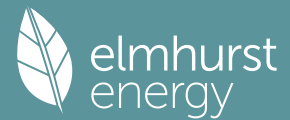
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3954	0.3876	0.3799	0.3411	0.3334	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							109.3926 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												50.0075
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7382 (42)
Hot water usage for mixer showers	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	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)
Water storage loss:												1662.1611
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019 (46)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645 (62)
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
12Total per year (kWh/year)												2007.1523 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708 (65)

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	3.0000	3.0000	3.0000	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)	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865 (72)
Total internal gains	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651 (73)

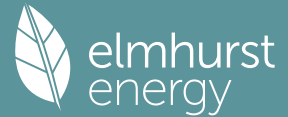
6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			9.3800	11.2829	0.6300	0.7000	0.7700	32.3442 (75)				
Southeast			1.6500	36.7938	0.6300	0.7000	0.7700	18.5537 (77)				
Solar gains	50.8980	97.4415	161.8602	248.3843	321.8695	338.7458	318.5953	260.8361	191.3602	115.3878	62.9205	42.2920 (83)
Total gains	460.2194	514.5460	562.9758	635.2249	690.3745	691.4239	658.7386	602.1344	542.3670	481.2387	450.0123	443.8572 (84)

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, nil,m (see Table 9a)	

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	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	0.9232	0.8939	0.8435	0.7369	0.5920	0.4344	0.3227	0.3650	0.5652	0.7836	0.8896	0.9296 (86)
MIT	19.3209	19.5873	19.9741	20.4555	20.7799	20.9380	20.9816	20.9728	20.8587	20.4359	19.8228	19.2807 (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	0.9132	0.8805	0.8240	0.7065	0.5492	0.3807	0.2607	0.2993	0.5077	0.7506	0.8736	0.9203 (89)
MIT 2	18.1507	18.4822	18.9590	19.5394	19.9047	20.0728	20.1099	20.1057	19.9999	19.5328	18.7882	18.1063 (90)
Living area fraction	18.8912	19.1815	19.6013	20.1191	20.4585	20.6203	20.6614	20.6544	20.5434	20.1043	19.4428	18.8495 (92)
MIT	18.8912	19.1815	19.6013	20.1191	20.4585	20.6203	20.6614	20.6544	20.5434	20.1043	19.4428	18.8495 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8912	19.1815	19.6013	20.1191	20.4585	20.6203	20.6614	20.6544	20.5434	20.1043	19.4428	18.8495 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8970	0.8647	0.8120	0.7068	0.5664	0.4116	0.2991	0.3395	0.5362	0.7503	0.8597	0.9046 (94)
Useful gains	412.8337	444.9302	457.1261	449.0055	391.0032	284.5995	197.0282	204.4448	290.8375	361.0629	386.8975	401.4945 (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	742.4958	724.8309	663.2178	561.0454	436.9892	297.1505	200.4652	209.5681	319.3598	474.1966	618.6928	737.8736 (97)
Space heating kWh	245.2686	188.0933	153.3322	80.6687	34.2135	0.0000	0.0000	0.0000	0.0000	84.1715	166.8926	250.2661 (98a)
Space heating requirement - total per year (kWh/year)												1202.9065
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	245.2686	188.0933	153.3322	80.6687	34.2135	0.0000	0.0000	0.0000	0.0000	84.1715	166.8926	250.2661 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1202.9065
Space heating per m2										(98c) / (4) =		23.2986 (99)

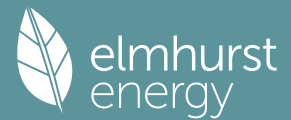
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	245.2686	188.0933	153.3322	80.6687	34.2135	0.0000	0.0000	0.0000	0.0000	84.1715	166.8926	250.2661 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	265.7298	203.7847	166.1238	87.3984	37.0678	0.0000	0.0000	0.0000	0.0000	91.1934	180.8154	271.1442 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
Efficiency of water heater (217)m	84.5573	84.2349	83.6376	82.5546	81.2489	79.8000	79.8000	79.8000	79.8000	82.6097	83.9446	79.8000 (216)
Fuel for water heating, kWh/month	232.4706	206.5531	221.6200	199.0911	197.2088	182.1778	180.7890	187.3239	188.6473	201.7372	209.3010	229.9811 (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	7.0685	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												1303.2573 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	79.8000
Water heating fuel used	2436.9009 (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	3529.1569 (238)

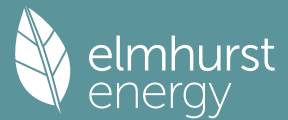
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1303.2573	0.2100	273.6840 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2436.9009	0.2100	511.7492 (264)
Space and water heating			785.4332 (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			760.6275 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.7300 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1303.2573	1.1300	1472.6808 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2436.9009	1.1300	2753.6981 (278)
Space and water heating			4226.3788 (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			4091.8277 (286)
Target Primary Energy Rate (TPER)			79.2500 (287)

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Property Reference	Flat 203 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 203 WCS - Green	Prop Type Ref		Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	85 B	DER	2.83	TER	12.20	
Environmental	98 A	% DER < TER				76.80
CO ₂ Emissions (t/year)	0.2	DFEE	29.56	TFEE	29.79	
Compliance Check	See BREL	% DFEE < TFEE				0.79
% DPER < TPER	53.17	DPER	30.41	TPER	64.93	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.0000 (1b)	x 2.5200 (2b)	= 186.4800 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.4800 (5)

2. Ventilation rate

	m ³ 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)

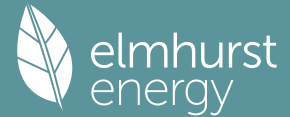
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9799 (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	0.0000	20.0000	191.6000	(32)
Corridor Wall	34.0200	0.0000	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) = 7446.2799 (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						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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	13.8596	13.6808	13.5019	12.6077	12.4288	11.5346	11.5346	11.3558	11.8923	12.4288	12.7865	13.1442	
Average = Sum(39)m / 12 =	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)
													52.4690
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in month	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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1976.1681
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072	(62)
WVHRS	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	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2714.1251 (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)
Heat gains from water heating, kWh/month	118.2986	105.2621	113.1527	102.3175	101.1804	93.3163	93.5072	95.9193	95.5620	104.0220	107.5542	117.3493	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	

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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	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	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)	-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)	159.0035	156.6400	152.0869	142.1076	135.9951	129.6060	125.6817	128.9238	132.7250	139.8145	149.3808	157.7276 (72)
Total internal gains	527.6676	538.6031	517.4949	499.4938	475.4029	458.8497	442.3455	443.4453	456.1160	471.2271	498.7719	517.2827 (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	680.1945	805.6074	901.9321	1007.8620	1074.0547	1066.0329	1022.3829	954.1609	883.1618	771.4764	682.7741	646.9661 (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, n _{l,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	0.8746	0.8073	0.7187	0.5808	0.4388	0.3060	0.2207	0.2461	0.3958	0.6326	0.8100	0.8877 (86)
MIT	20.0258	20.3164	20.5935	20.8381	20.9502	20.9901	20.9978	20.9967	20.9744	20.8176	20.4199	19.9770 (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	0.8625	0.7911	0.6978	0.5552	0.4101	0.2754	0.1881	0.2115	0.3601	0.6022	0.7915	0.8767 (89)
MIT 2	19.1849	19.5392	19.8716	20.1628	20.2868	20.3372	20.3437	20.3451	20.3191	20.1480	19.6797	19.1319 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.6284	19.9491	20.2524	20.5190	20.6367	20.6816	20.6887	20.6887	20.6648	20.5012	20.0701	19.5776 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6284	19.9491	20.2524	20.5190	20.6367	20.6816	20.6887	20.6887	20.6648	20.5012	20.0701	19.5776 (93)

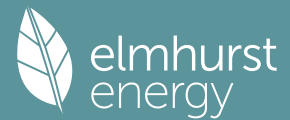
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8490	0.7817	0.6955	0.5625	0.4232	0.2912	0.2052	0.2296	0.3778	0.6100	0.7838	0.8630 (94)
Ext temp.	577.5144	629.7753	627.3191	566.8881	454.5602	310.4068	209.8284	219.0963	333.6233	470.6148	535.1460	558.3409 (95)
Heat loss rate W	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)
Space heating kWh	824.1404	806.4350	734.4853	610.1547	467.6999	312.8396	210.3245	219.8487	340.0430	518.1765	683.4281	815.7874 (97)
Space heating requirement - total per year (kWh/year)	183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98a)
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)
Space heating contribution - total per year (kWh/year)	183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	(98c) / (4) =											
Space heating per m2	10.2237 (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	0.9780	0.9882	0.9842	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	472.9277	376.1656	383.4362	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1189.1146	1140.4734	1061.9363	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	515.6545	568.6450	504.8040	0.0000	0.0000	0.0000	0.0000 (104)

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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	128.9136	142.1613	126.2010	0.0000	0.0000	0.0000 (107)
Space cooling requirement											397.2759 (107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402	
307a												
Space heating requirement												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	

Water heating

Annual water heating requirement	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072
310a	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072
Water heating fuel	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	31.9885	35.2757	31.3154	0.0000	0.0000	0.0000	4.0300 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	31.9885	35.2757	31.3154	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	16.7718	15.1488	16.7718	16.2308	16.7718	16.2308	16.7718	16.2308	16.7718	16.2308	16.7718	16.7718 (331)
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 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating											756.5538	(307)
Space heating fuel - secondary											0.0000	(309)
Water heating fuel - community heating											2714.1251	(310)
Efficiency of water heater											0.0000	(311)
Electricity used for heat distribution											7.5655	(313)
Space cooling fuel											98.5796	(321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)											197.4749	(330a)
Total electricity for the above, kWh/year											197.4749	(331)
Electricity for lighting (calculated in Appendix L)											154.3899	(332)

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

PV generation											0.0000	(333)
Wind generation											0.0000	(334)
Hydro-electric generation (Appendix N)											0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(335)
Appendix Q - special features												
Energy saved or generated											-0.0000	(336)
Energy used											0.0000	(337)
Total delivered energy for all uses											3921.1234	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	991.6226	0.1573	34.0006 (367)
Electrical energy for heat distribution (space & water)	7.5655	0.0000	5.0115 (372)
Overall CO2 factor for heat network			0.0427 (386)
Total CO2 associated with community systems			148.1966 (373)
Space and water heating			148.1966 (376)
Space cooling	98.5796	0.1142	11.2616 (377)
Pumps, fans and electric keep-hot	197.4749	0.1387	27.3922 (378)
Energy for lighting	154.3899	0.1443	22.2832 (379)
Total CO2, kg/year			209.1336 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8300 (384)

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13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	991.6226	1.5823	342.0201	(467)
Electrical energy for heat distribution (space & water)	7.5655	0.0000	53.2422	(472)
Overall CO2 factor for heat network			0.4536	(486)
Total CO2 associated with community systems			1574.4477	(473)
Space and water heating			1574.4477	(476)
Space cooling	98.5796	1.4210	140.0829	(477)
Pumps, fans and electric keep-hot	197.4749	1.5128	298.7400	(478)
Energy for lighting	154.3899	1.5338	236.8084	(479)
Total Primary energy kWh/year			2250.0789	(483)
Dwelling Primary energy Rate (DPER)			30.4100	(484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
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

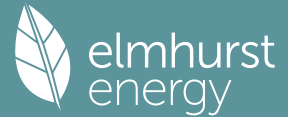
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	30.0000 / (5) =	0.1609 (8)
Pressure Test Method		Yes
Measured/design AP50		Blower Door
Infiltration rate		5.0000 (17)
Number of sides sheltered		0.4109 (18)
		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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

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

110.6254 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.0800	0.0900	0.9072
E16 Corner (normal)	2.5200	-0.0900	-0.2268
E17 Corner (inverted - internal area greater than external area)	2.5200	0.0600	0.1512
E18 Party wall between dwellings	4.8600	0.0200	0.0972
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.3900	0.0500	0.5695
E1 Steel lintel with perforated steel base plate	10.4400	0.0500	0.5220
E3 Sill	41.0000	0.0500	2.0500
E4 Jamb	54.4400	0.0700	3.8108
E7 Party floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)			7.8811 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			0.0000
Point Thermal bridges		(36a) =	
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
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

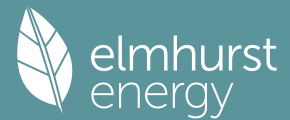
4. Water heating energy requirements (kWh/year)

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 content (annual)	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)	
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:													
Store volume												172.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8158 (55)	
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)	
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	253.5384	224.2257	238.0619	208.7732	202.0550	181.7019	178.9777	186.2323	188.4560	210.6011	224.5225	250.6834 (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	224.5362	198.5758	211.2029	186.5329	181.3278	163.9655	162.3526	168.5532	170.1052	188.9676	200.0144	222.2182 (64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2278.3524 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month	106.9996	95.0565	101.8537	91.3830	89.8814	82.3818	82.2081	84.6203	84.6275	92.7229	96.6196	106.0503 (65)	

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

Metabolic gains (Table 5), Watts												
(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	3.0000	3.0000	3.0000	3.0000	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)

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Water heating gains (Table 5)												
Total internal gains	143.8167	141.4532	136.9001	126.9208	120.8083	114.4191	110.4948	113.7370	117.5382	124.6276	134.1939	142.5407 (72)
	515.4794	526.4147	505.3066	487.3056	463.2147	443.6614	427.1572	428.2571	440.9277	459.0389	486.5836	505.0944 (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	655.9874	772.3835	859.4667	955.6520	1014.7508	1003.0632	961.5471	898.7715	834.3460	735.6362	656.0875	624.5586 (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, n _{l,m} (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	30.8791	30.9619	31.0435	31.4325	31.5064	31.8550	31.8550	31.9204	31.7198	31.5064	31.3573	31.2029
util living area	3.0586	3.0641	3.0696	3.0955	3.1004	3.1237	3.1237	3.1280	3.1147	3.1004	3.0905	3.0802
	0.9260	0.8857	0.8275	0.7217	0.5853	0.4333	0.3199	0.3546	0.5393	0.7637	0.8881	0.9342 (86)
MIT	19.3023	19.6394	20.0410	20.4905	20.7877	20.9388	20.9821	20.9751	20.8769	20.4814	19.8337	19.2456 (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	0.9161	0.8714	0.8066	0.6904	0.5422	0.3792	0.2579	0.2899	0.4822	0.7291	0.8717	0.9253 (89)
MIT 2	18.1215	18.5393	19.0316	19.5717	19.9055	20.0664	20.1030	20.1000	20.0089	19.5767	18.7953	18.0567 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.5274 (91)
MIT	18.7443	19.1195	19.5640	20.0563	20.3708	20.5265	20.5667	20.5616	20.4667	20.0539	19.3430	18.6838 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7443	19.1195	19.5640	20.0563	20.3708	20.5265	20.5667	20.5616	20.4667	20.0539	19.3430	18.6838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8983	0.8537	0.7932	0.6887	0.5555	0.4048	0.2899	0.3229	0.5057	0.7270	0.8556	0.9081 (94)
Ext temp.	589.2805	659.4217	681.7125	658.1807	563.6506	406.0872	278.7468	290.2159	421.9600	534.7923	561.3590	567.1627 (95)
Heat loss rate W	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)
Space heating kWh	1063.6927	1044.3409	956.9540	807.0960	625.8142	423.0662	283.1614	296.4668	456.4230	682.3307	887.8364	1055.5295 (97)
Space heating requirement - total per year (kWh/year)	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98a)
Solar heating kWh												1678.0540
Solar heating contribution - total per year (kWh/year)	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)
Space heating kWh	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1678.0540
Space heating per m2										(98c) / (4) =		22.6764 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98)
Space heating fuel (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating efficiency (main heating system 2)	382.4081	280.2445	221.8632	116.1636	50.1080	0.0000	0.0000	0.0000	0.0000	118.9259	254.6736	393.6565 (211)
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 (212)
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 (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)

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Water heating requirement	224.5362	198.5758	211.2029	186.5329	181.3278	163.9655	162.3526	168.5532	170.1052	188.9676	200.0144	222.2182 (64)
Efficiency of water heater (217)m	85.0697	84.6536	83.9906	82.8654	81.4782	79.8000	79.8000	79.8000	79.8000	82.8868	84.4228	79.8000 (216)
Fuel for water heating, kWh/month	263.9439	234.5745	251.4603	225.1033	222.5476	205.4706	203.4494	211.2195	213.1644	227.9828	236.9198	85.1553 (217)
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	7.0685	7.3041	7.0685	7.3041	7.0685 (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												1818.0434 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2756.7924 (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												4103.9208 (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	1818.0434	0.2100	381.7891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2756.7924	0.2100	578.9264 (264)
Space and water heating			960.7155 (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			902.9043 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.2000 (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	1818.0434	1.1300	2054.3890 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2756.7924	1.1300	3115.1754 (278)
Space and water heating			5169.5645 (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			4804.5745 (286)
Target Primary Energy Rate (TPER)			64.9300 (287)

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Property Reference	Flat 204 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 204 VL - Be Green		Prop Type Ref	Flat 103 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	83 B	DER	3.67	TER	17.37	
Environmental	97 A	% DER < TER				78.87
CO ₂ Emissions (t/year)	0.17	DFEE	41.22	TFEE	44.54	
Compliance Check	See BREL	% DFEE < TFEE				7.46
% DPER < TPER	58.12	DPER	38.99	TPER	93.10	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

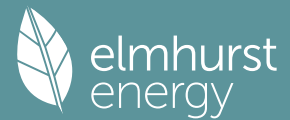
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												47.4445	

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

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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)													
Distribution loss (46)m = 0.15 x (45)m													
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)

Water storage loss:
 Store volume 172.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)
 Temperature factor from Table 2b 0.7800 (49)
 Enter (49) or (54) in (55) 1.2714 (55)

Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h 235.6813 208.8427 222.6207 197.2013 192.2314 174.3537 172.7539 178.8763 180.0527 199.4428 210.4924 233.2716 (64)
 Total per year (kWh/year) = Sum(64)m = 2405.8210 (64)
 2406 (64)

12Total per year (kWh/year)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 107.6650 95.9055 103.3223 93.9252 93.2179 86.3284 86.7416 88.7773 88.2233 95.6157 98.3445 106.8637 (65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				13.1800	11.2829		0.4700		0.7000		0.7700		33.9052 (75)
Southeast				1.9800	36.7938		0.4700		0.7000		0.7700		16.6100 (77)
Southwest				0.9000	36.7938		0.4700		0.7000		0.7700		7.5500 (79)
Solar gains	58.0652	110.1685	180.6511	273.9755	352.6409	370.2215	348.5556	286.7900	212.4837	129.8252	71.5997	48.3646	(83)
Total gains	481.3196	541.2475	595.6645	674.6437	734.8764	739.5602	705.2938	644.6827	580.1329	509.3804	472.5028	463.8166	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.5911	25.6593	25.7279	26.0766	26.1474	26.5076	26.5076	26.5808	26.3623	26.1474	26.0061	25.8663	
alpha	2.7061	2.7106	2.7152	2.7384	2.7432	2.7672	2.7672	2.7721	2.7575	2.7432	2.7337	2.7244	
util living area	0.8834	0.8458	0.7857	0.6713	0.5301	0.3839	0.2845	0.3217	0.5028	0.7203	0.8409	0.8915	(86)
MIT	19.2088	19.5053	19.9227	20.4268	20.7604	20.9288	20.9770	20.9674	20.8470	20.4078	19.7550	19.1645	(87)
Th 2	20.1418	20.1439	20.1460	20.1565	20.1586	20.1691	20.1691	20.1712	20.1649	20.1586	20.1544	20.1502	(88)
util rest of house	0.8714	0.8307	0.7654	0.6426	0.4927	0.3388	0.2330	0.2670	0.4532	0.6882	0.8231	0.8803	(89)
MIT 2	18.0582	18.4254	18.9380	19.5460	19.9258	20.1110	20.1547	20.1498	20.0318	19.5407	18.7492	18.0088	(90)
Living area fraction	18.7171	19.0439	19.5019	20.0504	20.4038	20.5793	20.6256	20.6181	fLA = Living area / (4) =	20.0373	19.3252	0.5727	(91)
MIT	18.7171	19.0439	19.5019	20.0504	20.4038	20.5793	20.6256	20.6181	20.4986	20.0373	19.3252	18.6707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7171	19.0439	19.5019	20.0504	20.4038	20.5793	20.6256	20.6181	20.4986	20.0373	19.3252	18.6707	(93)

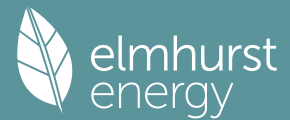
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8480	0.8087	0.7485	0.6388	0.5039	0.3613	0.2615	0.2968	0.4735	0.6832	0.8032	0.8571	(94)
Ext temp.	408.1421	437.6866	445.8683	430.9397	370.2737	267.2151	184.4369	191.3346	274.7050	348.0168	379.5131	397.5418	(95)
Heat loss rate W	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)
Space heating kWh	697.4629	682.4229	625.6534	529.3847	412.1070	279.2625	188.0154	196.4607	300.4932	446.8367	581.9834	692.6037	(97)
Space heating requirement - total per year (kWh/year)	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98a)
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)	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1054.3087	
Space heating per m2										(98c) / (4) =		20.2752	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(301)
Fraction of space heat from community system													1.0000	(302)
Fraction of heat from community Heat pump-Space and Water													1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating													1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system													1.0000	(306)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating:														
Space heating requirement														
	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261	(98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00														

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307a	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261
Space heating requirement	215.2547	164.4628	133.7601	70.8804	31.1239	0.0000	0.0000	0.0000	0.0000	73.5220	145.7786	219.5261 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.7900	12.4555	13.7900	13.3451	13.7900	13.3451	13.7900	13.7900	13.3451	13.7900	13.3451	13.7900 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1054.3087 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												10.5431 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												162.3658 (330a)
Total electricity for the above, kWh/year												162.3658 (331)
Electricity for lighting (calculated in Appendix L)												136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3758.8322 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	988.6085	0.1555	46.8298 (367)
Electrical energy for heat distribution (space & water)	10.5431	0.0000	5.0240 (372)
Overall CO2 factor for heat network			0.0429 (386)
Total CO2 associated with community systems			148.5672 (373)
Space and water heating			148.5672 (376)
Pumps, fans and electric keep-hot	162.3658	0.1387	22.5221 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			190.7670 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	988.6085	1.5755	474.6033 (467)
Electrical energy for heat distribution (space & water)	10.5431	0.0000	53.1855 (472)
Overall CO2 factor for heat network			0.4545 (486)
Total CO2 associated with community systems			1572.7703 (473)
Space and water heating			1572.7703 (476)
Pumps, fans and electric keep-hot	162.3658	1.5128	245.6270 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			2027.5152 (483)
Dwelling Primary energy Rate (DPER)			38.9900 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

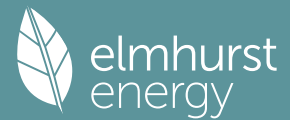
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4932 (36)

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

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	Jan 1.2721	Feb 1.2695	Mar 1.2670	Apr 1.2552	May 1.2530	Jun 1.2427	Jul 1.2427	Aug 1.2407	Sep 1.2466	Oct 1.2530	Nov 1.2574	Dec 1.2621 (40)
HLP HLP (average)												1.2552
Days in month	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)
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 content (annual)												
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)												
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)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(57)
Primary loss												
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS												
-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255	(63a)
PV diverter												
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223	(64)
12Total per year (kWh/year)												
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(65)

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

Metabolic gains (Table 5), Watts												
(66)m												
87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
77.0119	85.2631	77.0119	79.5789	77.0119	79.5789	77.0119	77.0119	79.5789	77.0119	79.5789	77.0119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans												
3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)												
129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains												
411.1980	419.0366	402.9570	388.6162	370.1790	354.2867	341.6819	342.8363	352.5972	367.4989	388.8511	403.3956	(73)

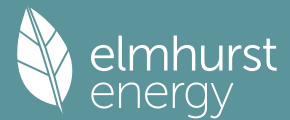
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Northeast				9.1100	11.2829	0.6300	0.7000	0.7700	31.4132 (75)			
Southeast				1.3700	36.7938	0.6300	0.7000	0.7700	15.4052 (77)			
Southwest				0.6200	36.7938	0.6300	0.7000	0.7700	6.9717 (79)			

Solar gains	53.7901	102.0587	167.3563	253.8173	326.6983	342.9869	322.9142	265.6903	196.8478	120.2693	66.3283	44.8036 (83)
Total gains	464.9881	521.0952	570.3132	642.4335	696.8773	697.2735	664.5961	608.5266	549.4450	487.7682	455.1794	448.1992 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.8993	20.9416	20.9832	21.1811	21.2185	21.3945	21.3945	21.4274	21.3263	21.2185	21.1429	21.0645
alpha	2.3933	2.3961	2.3989	2.4121	2.4146	2.4263	2.4263	2.4285	2.4218	2.4146	2.4095	2.4043
util living area	0.9229	0.8986	0.8586	0.7758	0.6563	0.5115	0.3948	0.4399	0.6321	0.8122	0.8958	0.9285 (86)
MIT	18.3938	18.7041	19.2004	19.8694	20.4230	20.7784	20.9145	20.8867	20.6108	19.9071	19.0570	18.3427 (87)
Th 2	19.8628	19.8648	19.8668	19.8761	19.8779	19.8860	19.8860	19.8875	19.8829	19.8779	19.8743	19.8706 (88)
util rest of house	0.9122	0.8848	0.8389	0.7444	0.6077	0.4414	0.3056	0.3483	0.5646	0.7785	0.8794	0.9186 (89)
MIT 2	16.8663	17.2545	17.8722	18.6901	19.3331	19.7171	19.8397	19.8220	19.5599	18.7579	17.7101	16.8070 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.7411	18.0847	18.6329	19.3655	19.9573	20.3249	20.4553	20.4317	20.1618	19.4160	18.4815	17.6865 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.7411	18.0847	18.6329	19.3655	19.9573	20.3249	20.4553	20.4317	20.1618	19.4160	18.4815	17.6865 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8863	0.8577	0.8132	0.7283	0.6114	0.4702	0.3524	0.3946	0.5826	0.7624	0.8539	0.8934 (94)
Useful gains	412.1128	446.9366	463.8046	467.8682	426.0651	327.8243	234.2013	240.1310	320.1266	371.8860	388.6633	400.4013 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	889.1192	870.3943	799.3691	683.0737	537.9948	369.9316	249.1209	260.1229	392.9523	574.4020	744.1997	885.1270 (97)
Space heating kWh	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359 (98a)
Space heating requirement - total per year (kWh/year)												1894.6340
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1894.6340
Space heating per m2												(98c) / (4) = 36.4353 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	354.8928	284.5635	249.6600	154.9480	83.2757	0.0000	0.0000	0.0000	0.0000	150.6719	255.9862	360.6359 (98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)	
Space heating fuel (main heating system)	384.4992	308.3029	270.4876	167.8743	90.2228	0.0000	0.0000	0.0000	0.0000	163.2415	277.3415	390.7214 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)	
Efficiency of water heater	85.3626	85.1504	84.7227	83.9223	82.6606	79.8000	79.8000	79.8000	79.8000	83.8290	84.8972	79.8000 (216)	
Fuel for water heating, kWh/month	230.8724	204.8569	219.3356	196.3264	194.3045	182.6008	181.2006	187.7579	189.0926	199.2862	207.4728	228.4330 (219)	
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)													

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(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2052.6912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2421.5399	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												129.1416	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-514.0461	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4175.3267	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2052.6912	0.2100	431.0651 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2421.5399	0.2100	508.5234 (264)
Space and water heating			939.5885 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.1416	0.1443	18.6391 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-296.8229	0.1332	-39.5451
PV Unit electricity exported	-217.2232	0.1252	-27.1935
Total			-66.7387 (269)
Total CO2, kg/year			903.4183 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.3700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2052.6912	1.1300	2319.5410 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2421.5399	1.1300	2736.3401 (278)
Space and water heating			5055.8811 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.1416	1.5338	198.0817 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-296.8229	1.4923	-442.9520
PV Unit electricity exported	-217.2232	0.4595	-99.8117
Total			-542.7636 (283)
Total Primary energy kWh/year			4841.3000 (286)
Target Primary Energy Rate (TPER)			93.1000 (287)

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Property Reference	Flat 205 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 205 VL - Be Green		Prop Type Ref	Flat 103 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	83 B	DER	3.50	TER	15.76	
Environmental	98 A	% DER < TER				77.79
CO ₂ Emissions (t/year)	0.17	DFEE	37.80	TFEE	37.14	
Compliance Check	See BREL	% DFEE < TFEE				-1.78
% DPER < TPER	55.94	DPER	37.21	TPER	84.44	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

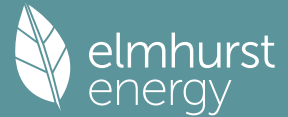
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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	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

Water storage loss:
 Store volume 172.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)
 Temperature factor from Table 2b 0.7800 (49)
 Enter (49) or (54) in (55) 1.2714 (55)

Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)

12Total per year (kWh/year) = Sum(64)m = 2405.8210 (64)
 2406 (64)

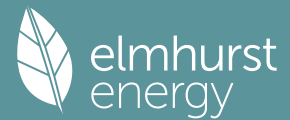
Electric shower(s) 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341 (72)
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)			
Southeast				5.8200	36.7938	0.4700	0.7000	0.7700	48.8233 (77)			
Northwest				1.8000	11.2829	0.4700	0.7000	0.7700	4.6305 (81)			
Solar gains	82.4713	151.6556	237.1887	343.6478	430.3325	447.1985	422.8332	355.1083	273.5739	175.6161	100.8169	69.2612 (83)
Total gains	505.7257	582.7346	652.2020	744.3160	812.5679	816.5372	779.5714	713.0009	641.2231	555.1714	501.7201	484.7132 (84)

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, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	30.6089	30.6951	30.7818	31.2228	31.3125	31.7690	31.7690	31.8618	31.5848	31.3125	31.1336	30.9567
util living area	3.0406	3.0463	3.0521	3.0815	3.0875	3.1179	3.1179	3.1241	3.1057	3.0875	3.0756	3.0638
	0.8814	0.8325	0.7579	0.6267	0.4786	0.3376	0.2466	0.2799	0.4513	0.6855	0.8308	0.8915 (86)
MIT	19.5921	19.8950	20.2658	20.6584	20.8775	20.9695	20.9914	20.9872	20.9245	20.6216	20.0722	19.5442 (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	0.8690	0.8162	0.7360	0.5974	0.4434	0.2981	0.2033	0.2334	0.4054	0.6520	0.8119	0.8799 (89)
MIT 2	18.5531	18.9249	19.3745	19.8412	20.0844	20.1871	20.2061	20.2054	20.1434	19.8133	19.1578	18.5001 (90)
Living area fraction	fLA = Living area / (4) =											0.6206 (91)
MIT	19.1979	19.5269	19.9276	20.3484	20.5766	20.6726	20.6935	20.6906	20.6281	20.3149	19.7253	19.1480 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1979	19.5269	19.9276	20.3484	20.5766	20.6726	20.6935	20.6906	20.6281	20.3149	19.7253	19.1480 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8517	0.8017	0.7285	0.6030	0.4601	0.3213	0.2299	0.2617	0.4301	0.6570	0.7996	0.8626 (94)
Ext temp.	430.7315	467.1884	475.1413	448.8554	373.8801	262.3720	179.2053	186.6153	275.7756	364.7438	401.1855	418.1263 (95)
Heat loss rate W	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)
Space heating kWh	682.4273	668.1328	611.6242	514.1047	397.4725	268.0122	180.6627	188.8102	289.7942	435.0116	568.5791	677.0312 (97)
Space heating requirement - total per year (kWh/year)	187.2617	135.0347	101.5433	46.9795	17.5527	0.0000	0.0000	0.0000	0.0000	52.2792	120.5233	192.6253 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	187.2617	135.0347	101.5433	46.9795	17.5527	0.0000	0.0000	0.0000	0.0000	52.2792	120.5233	192.6253 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												853.7997
Space heating per m2	(98c) / (4) =											16.4192 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	187.2617	135.0347	101.5433	46.9795	17.5527	0.0000	0.0000	0.0000	0.0000	52.2792	120.5233	192.6253 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	187.2617	135.0347	101.5433	46.9795	17.5527	0.0000	0.0000	0.0000	0.0000	52.2792	120.5233	192.6253
Space heating requirement												

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187.2617	135.0347	101.5433	46.9795	17.5527	0.0000	0.0000	0.0000	0.0000	52.2792	120.5233	192.6253 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)											0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating											
Annual water heating requirement											
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00											
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	233.2716
Water heating fuel											
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Pumps and Fa	13.7900	12.4555	13.7900	13.3451	13.7900	13.3451	13.7900	13.3451	13.7900	13.3451	13.7900 (315)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)											
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)											
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year											
Space heating fuel - community heating											853.7997 (307)
Space heating fuel - secondary											0.0000 (309)
Water heating fuel - community heating											2405.8210 (310)
Efficiency of water heater											0.0000 (311)
Electricity used for heat distribution											8.5380 (313)
Space cooling fuel											0.0000 (321)
Electricity for pumps and fans:											
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)											
mechanical ventilation fans (SFP = 0.9920)											162.3658 (330a)
Total electricity for the above, kWh/year											162.3658 (331)
Electricity for lighting (calculated in Appendix L)											136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)											
PV generation											0.0000 (333)
Wind generation											0.0000 (334)
Hydro-electric generation (Appendix N)											0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)											0.0000 (335)
Appendix Q - special features											
Energy saved or generated											-0.0000 (336)
Energy used											0.0000 (337)
Total delivered energy for all uses											3558.3233 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	931.3202	0.1563	38.1164 (367)
Electrical energy for heat distribution (space & water)	8.5380	0.0000	4.7190 (372)
Overall CO2 factor for heat network			0.0428 (386)
Total CO2 associated with community systems			139.5488 (373)
Space and water heating			139.5488 (376)
Pumps, fans and electric keep-hot	162.3658	0.1387	22.5221 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			181.7485 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	931.3202	1.5784	385.0506 (467)
Electrical energy for heat distribution (space & water)	8.5380	0.0000	50.0511 (472)
Overall CO2 factor for heat network			0.4541 (486)
Total CO2 associated with community systems			1480.0833 (473)
Space and water heating			1480.0833 (476)
Pumps, fans and electric keep-hot	162.3658	1.5128	245.6270 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			1934.8282 (483)
Dwelling Primary energy Rate (DPER)			37.2100 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

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	0.0200	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

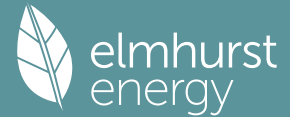
Total fabric heat loss (33) + (36) + (36a) = 32.8302 (37)

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 month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541 (44)
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1667.8640
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2012.0777 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)

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

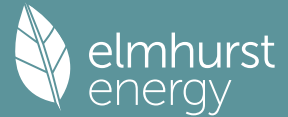
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472 (72)
Total internal gains	411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				6.6300	11.2829	0.6300	0.7000		0.7700		22.8617 (75)	
Southeast				3.4200	36.7938	0.6300	0.7000		0.7700		38.4568 (77)	
Northwest				1.0600	11.2829	0.6300	0.7000		0.7700		3.6551 (81)	
Solar gains	64.9735	119.4818	186.8753	270.7613	339.0677	352.3596	333.1604	279.7938	215.5454	138.3607	79.4273	54.5659 (83)
Total gains	476.1676	538.5140	589.8283	659.3734	709.2427	706.6422	674.8383	622.6261	568.1386	505.8557	468.2743	457.9576 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,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	0.9245	0.8955	0.8493	0.7559	0.6253	0.4731	0.3562	0.3976	0.5921	0.7942	0.8931	0.9308 (86)
MIT	18.9686	19.2679	19.6992	20.2455	20.6544	20.8862	20.9621	20.9477	20.7800	20.2539	19.5389	18.9197 (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	0.9140	0.8816	0.8292	0.7242	0.5787	0.4104	0.2809	0.3192	0.5285	0.7598	0.8765	0.9212 (89)
MIT 2	17.6406	18.0134	18.5465	19.2082	19.6741	19.9201	19.9854	19.9775	19.8225	19.2368	18.3649	17.5848 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.6206 (91)
MIT	18.4647	18.7919	19.2619	19.8519	20.2825	20.5196	20.5915	20.5796	20.4167	19.8680	19.0935	18.4133 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4647	18.7919	19.2619	19.8519	20.2825	20.5196	20.5915	20.5796	20.4167	19.8680	19.0935	18.4133 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8947	0.8621	0.8127	0.7193	0.5925	0.4435	0.3258	0.3651	0.5560	0.7549	0.8589	0.9024 (94)
Useful gains	426.0367	464.2322	479.3608	474.3101	420.2114	313.4084	219.8809	227.3474	315.8818	381.8654	402.1901	413.2768 (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	827.3460	809.5554	742.0279	630.0506	492.7504	336.6943	227.0274	237.3103	360.5832	532.1070	691.3824	822.8059 (97)
Space heating kWh	298.5741	232.0572	195.4243	112.1332	53.9691	0.0000	0.0000	0.0000	0.0000	111.7798	208.2184	304.6897 (98a)
Space heating requirement - total per year (kWh/year)												1516.8456
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	298.5741	232.0572	195.4243	112.1332	53.9691	0.0000	0.0000	0.0000	0.0000	111.7798	208.2184	304.6897 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1516.8456
Space heating per m ²										(98c) / (4) =		29.1701 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	298.5741	232.0572	195.4243	112.1332	53.9691	0.0000	0.0000	0.0000	0.0000	111.7798	208.2184	304.6897 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	323.4822	251.4162	211.7273	121.4877	58.4713	0.0000	0.0000	0.0000	0.0000	121.1049	225.5887	330.1080 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	84.9888	84.7007	84.1729	83.2155	81.8874	79.8000	79.8000	79.8000	79.8000	83.1795	84.4360	79.8000 (216)
Fuel for water heating, kWh/month	231.8879	205.9445	220.7683	197.9939	196.1392	182.6008	181.2006	187.7579	189.0926	200.8423	208.6060	85.0551 (217)
Space cooling fuel requirement												229.4069 (219)
(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)	-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)	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)	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)	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)	-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)	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)	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)	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												1643.3864 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2432.2410 (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	3776.7163 (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	1643.3864	0.2100	345.1111 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2432.2410	0.2100	510.7706 (264)
Space and water heating			855.8817 (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			819.7105 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.7600 (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	1643.3864	1.1300	1857.0266 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2432.2410	1.1300	2748.4323 (278)
Space and water heating			4605.4589 (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			4390.8678 (286)
Target Primary Energy Rate (TPER)			84.4400 (287)

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Property Reference	Flat 301 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 301 VL - Be Green	Prop Type Ref		Flat 103 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	83 B	DER	3.42	TER	16.09	
Environmental	97 A	% DER < TER				78.74
CO ₂ Emissions (t/year)	0.21	DFEE	41.97	TFEE	46.76	
Compliance Check	See BREL	% DFEE < TFEE				10.23
% DPER < TPER	57.45	DPER	36.21	TPER	85.08	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.0000 (1b)	x 2.4000 (2b)	= 160.8000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 160.8000 (5)

2. Ventilation rate

	m ³ 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)

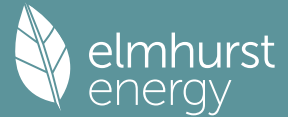
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
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	0.3000	8.3100				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5526 (36)
Point Thermal bridges							0.0000 (36a) =
Total fabric heat loss							(33) + (36) + (36a) = 52.2417 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	11.9510	11.7968	11.6426	10.8715	10.7173	9.9462	9.9462	9.7920	10.2546	10.7173	11.0257	11.3341	
Average = Sum(39)m / 12 =	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)
													63.0747
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

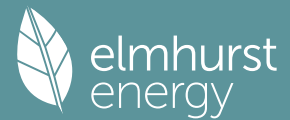
4. Water heating energy requirements (kWh/year)

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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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 content (annual)	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)
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:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270	(62)
WVHRS	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													
	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270	(64)
12Total per year (kWh/year)													
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	115.2705	102.5977	110.3534	99.9277	98.9129	91.3264	91.5806	93.8855	93.4722	101.6282	104.9316	114.3634	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	108.5574	

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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	33.8557 (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)	-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)	154.9335	152.6751	148.3244	138.7884	132.9475	126.8422	123.0922	126.1902	129.8225	136.5970	145.7383	153.7142 (72)
Total internal gains	496.6296	506.6233	487.0206	470.0943	447.6901	432.2209	416.8812	418.0056	429.8091	443.9739	469.6784	487.0183 (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	588.6297	681.6875	775.3029	909.0054	1013.8931	1027.1372	976.7909	877.9341	769.4627	650.6019	583.2158		563.5884 (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, n1,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	0.8795	0.8367	0.7690	0.6464	0.5030	0.3639	0.2714	0.3112	0.4923	0.7130	0.8375	0.8886 (86)	
MIT	18.8281	19.1933	19.7040	20.3050	20.7018	20.9038	20.9661	20.9518	20.7922	20.2460	19.4586	18.7683 (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	0.8679	0.8218	0.7487	0.6180	0.4667	0.3203	0.2212	0.2574	0.4435	0.6816	0.8202	0.8778 (89)	
MIT 2	17.5817	18.0345	18.6624	19.3870	19.8410	20.0636	20.1217	20.1130	19.9556	19.3391	18.3797	17.5121 (90)	
Living area fraction	18.4723	18.8625	19.4066	20.0429	20.4560	20.6639	20.7250	20.7123	fLA = Living area / (4) =	20.5533	19.9870	19.1506	0.7145 (91)
MIT	18.4723	18.8625	19.4066	20.0429	20.4560	20.6639	20.7250	20.7123	20.5533	19.9870	19.1506	18.4096 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.4723	18.8625	19.4066	20.0429	20.4560	20.6639	20.7250	20.7123	20.5533	19.9870	19.1506	18.4096 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8419	0.7973	0.7305	0.6150	0.4805	0.3471	0.2555	0.2934	0.4675	0.6759	0.7979	0.8521 (94)	
Ext temp.	495.5719	543.5335	566.3386	559.0048	487.2043	356.4929	249.5490	257.5782	359.7058	439.7352	465.3583	480.2340 (95)	
Heat loss rate W	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)	
Space heating kWh	909.7556	894.1354	824.5294	703.2642	551.2702	377.1025	256.5242	267.5086	403.3099	590.9992	762.4090	903.3903 (97)	
Space heating requirement - total per year (kWh/year)	308.1527	235.6045	192.0940	103.8668	47.6651	0.0000	0.0000	0.0000	0.0000	112.5404	213.8765	314.8283 (98a)	
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)	308.1527	235.6045	192.0940	103.8668	47.6651	0.0000	0.0000	0.0000	0.0000	112.5404	213.8765	314.8283 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1528.6283	
Space heating per m2										(98c) / (4) =		22.8153 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	308.1527	235.6045	192.0940	103.8668	47.6651	0.0000	0.0000	0.0000	0.0000	112.5404	213.8765	314.8283 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													

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307a	308.1527	235.6045	192.0940	103.8668	47.6651	0.0000	0.0000	0.0000	0.0000	112.5404	213.8765	314.8283
Space heating requirement	308.1527	235.6045	192.0940	103.8668	47.6651	0.0000	0.0000	0.0000	0.0000	112.5404	213.8765	314.8283 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270
310a	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270
Water heating fuel	258.5552	228.9694	243.7667	215.2539	209.3594	189.3854	187.3072	194.2394	195.8390	217.5255	230.3032	255.8270 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	16.5282	14.9287	16.5282	15.9951	16.5282	15.9951	16.5282	16.5282	15.9951	16.5282	15.9951	16.5282 (331)
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 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1528.6283 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2626.3312 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												15.2863 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												194.6066 (330a)
Total electricity for the above, kWh/year												194.6066 (331)
Electricity for lighting (calculated in Appendix L)												155.5350 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4505.1012 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1187.1313	0.1553	67.8225 (367)
Electrical energy for heat distribution (space & water)	15.2863	0.0000	6.0709 (372)
Overall CO2 factor for heat network			0.0432 (386)
Total CO2 associated with community systems			179.5266 (373)
Space and water heating			179.5266 (376)
Pumps, fans and electric keep-hot	194.6066	0.1387	26.9943 (378)
Energy for lighting	155.5350	0.1443	22.4485 (379)
Total CO2, kg/year			228.9695 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4200 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1187.1313	1.5749	687.8403 (467)
Electrical energy for heat distribution (space & water)	15.2863	0.0000	64.0083 (472)
Overall CO2 factor for heat network			0.4556 (486)
Total CO2 associated with community systems			1892.8176 (473)
Space and water heating			1892.8176 (476)
Pumps, fans and electric keep-hot	194.6066	1.5128	294.4009 (478)
Energy for lighting	155.5350	1.5338	238.5648 (479)
Total Primary energy kWh/year			2425.7833 (483)
Dwelling Primary energy Rate (DPER)			36.2100 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

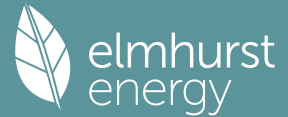
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 73.9536 (35)

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(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

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HLP	Jan 1.3008	Feb 1.2987	Mar 1.2966	Apr 1.2869	May 1.2851	Jun 1.2767	Jul 1.2767	Aug 1.2751	Sep 1.2799	Oct 1.2851	Nov 1.2888	Dec 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 content (annual)	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)	
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1888.3742	
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:													
Store volume												172.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8158 (55)	
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)	
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	244.4314	216.2124	229.6429	201.5858	195.2357	175.7172	173.1834	180.1156	182.1708	203.4017	216.6351	241.7032 (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	216.7173	191.7018	203.9768	180.3332	175.4290	158.7686	157.2968	163.2217	164.6351	182.7290	193.2154	214.5023 (64)	
								Total per year (kWh/year) = Sum(64)m =					2202.5269 (64)
12Total per year (kWh/year)												2203 (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	103.9715	92.3921	99.0543	88.9931	87.6139	80.3919	80.2816	82.5865	82.5377	90.3291	93.9970	103.0644 (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	176.0086	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	3.0000	3.0000	3.0000	3.0000	3.0000	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)	139.7467	137.4883	133.1375	123.6016	117.7607	111.6554	107.9053	111.0034	114.6357	121.4101	130.5514	138.5274 (72)
Total internal gains	484.4522	494.4470	474.8432	457.9173	435.5128	417.0439	401.7038	402.8283	414.6321	431.7966	457.5014	474.8410 (73)

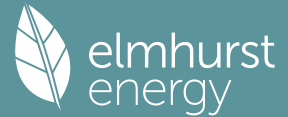
6. Solar gains

[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	555.3743	629.3985	697.0620	796.2336	871.9374	875.5969	833.2756	757.3414	676.4454	591.0772	545.0256	533.8686 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,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	0.9097	0.8835	0.8418	0.7593	0.6447	0.5093	0.3994	0.4450	0.6282	0.7999	0.8824	0.9158 (86)
MIT	17.7706	18.1265	18.7094	19.5008	20.1841	20.6519	20.8507	20.8080	20.4286	19.5547	18.5439	17.7064 (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	0.9037	0.8759	0.8313	0.7430	0.6198	0.4727	0.3513	0.3962	0.5939	0.7827	0.8736	0.9103 (89)
MIT 2	17.3016	17.6532	18.2280	19.0025	19.6563	20.0908	20.2620	20.2304	19.8971	19.0665	18.0731	17.2408 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	17.6367	17.9913	18.5720	19.3585	20.0334	20.4917	20.6826	20.6430	20.2769	19.4153	18.4095	17.5734 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6367	17.9913	18.5720	19.3585	20.0334	20.4917	20.6826	20.6430	20.2769	19.4153	18.4095	17.5734 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8719	0.8419	0.7969	0.7145	0.6063	0.4804	0.3760	0.4182	0.5891	0.7535	0.8406	0.8793 (94)
Useful gains	484.2346	529.9052	555.5231	568.9437	528.6758	420.6298	313.2902	316.7489	398.5112	445.3693	458.1352	469.4525 (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	1162.3427	1139.1138	1048.7472	901.7919	717.5423	503.9648	349.2212	362.5003	529.7068	759.0346	976.5724	1158.2283 (97)
Space heating kWh	504.5124	409.3882	366.9587	239.6508	140.5167	0.0000	0.0000	0.0000	0.0000	233.3670	373.2748	512.4492 (98a)
Space heating requirement - total per year (kWh/year)												2780.1178
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	504.5124	409.3882	366.9587	239.6508	140.5167	0.0000	0.0000	0.0000	0.0000	233.3670	373.2748	512.4492 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2780.1178
Space heating per m ²												(98c) / (4) = 41.4943 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	504.5124	409.3882	366.9587	239.6508	140.5167	0.0000	0.0000	0.0000	0.0000	233.3670	373.2748	512.4492 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	546.6007	443.5408	397.5717	259.6433	152.2391	0.0000	0.0000	0.0000	0.0000	252.8353	404.4148	555.1996 (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	216.7173	191.7018	203.9768	180.3332	175.4290	158.7686	157.2968	163.2217	164.6351	182.7290	193.2154	214.5023 (64)
Efficiency of water heater	85.8893	85.7169	85.3605	84.6984	83.5669	79.8000	79.8000	79.8000	79.8000	84.6094	85.5107	79.8000 (216)
Fuel for water heating, kWh/month	252.3216	223.6454	238.9591	212.9123	209.9266	198.9581	197.1137	204.5385	206.3096	215.9676	225.9548	249.5953 (219)
Space cooling fuel requirement	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)
(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)	-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)	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)	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)	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)	-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)	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)	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)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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												3012.0453	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2636.2027	(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												4791.2524	(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	3012.0453	0.2100	632.5295 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2636.2027	0.2100	553.6026 (264)
Space and water heating			1186.1321 (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			1078.2470 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.0900 (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	3012.0453	1.1300	3403.6112 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2636.2027	1.1300	2978.9090 (278)
Space and water heating			6382.5202 (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			5700.2954 (286)
Target Primary Energy Rate (TPER)			85.0800 (287)

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Property Reference	Flat 301 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 301 WCS - Green	Prop Type Ref		Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	84 B	DER	3.07	TER	13.79	
Environmental	98 A	% DER < TER				77.74
CO ₂ Emissions (t/year)	0.17	DFEE	33.41	TFEE	32.59	
Compliance Check	See BREL	% DFEE < TFEE				-2.50
% DPER < TPER	55.60	DPER	32.68	TPER	73.62	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0000 (1b)	x 2.5200 (2b)	= 153.7200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.7200 (5)

2. Ventilation rate

	m ³ 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)

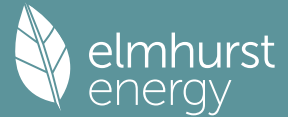
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
K1 Element	Length	Psi-value	Total				
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
													50.9283
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

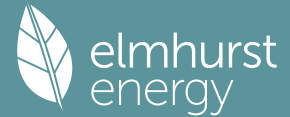
4. Water heating energy requirements (kWh/year)

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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027	(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	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027	(64)
Total per year (kWh/year) = Sum(64)m =													2542.0169 (64)
12Total per year (kWh/year)													2542 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	112.3625	100.0389	107.6650	97.6326	96.7354	89.4153	89.7304	91.9323	91.4652	99.3292	102.4129	111.4958	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	151.0248	148.8674	144.7110	135.6008	130.0207	124.1880	120.6053	123.5650	127.0350	133.5070	142.2402	149.8600 (72)
	468.1333	477.2788	459.0520	443.1240	422.2639	407.7927	393.5181	394.6571	405.6653	418.9551	442.9683	459.2266 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	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	608.8208	722.6637	810.0503	903.5925	961.3611	953.2554	915.1310	856.0402	794.3271	694.2700	612.5252	578.9492 (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, n _l (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	0.8727	0.8104	0.7289	0.6019	0.4642	0.3295	0.2389	0.2655	0.4197	0.6494	0.8136	0.8853 (86)	
MIT	19.7305	20.0607	20.3992	20.7240	20.9001	20.9755	20.9935	20.9908	20.9458	20.7053	20.1965	19.6725 (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	0.8597	0.7931	0.7063	0.5732	0.4304	0.2919	0.1981	0.2224	0.3771	0.6159	0.7938	0.8733 (89)	
MIT 2	18.7399	19.1426	19.5499	19.9351	20.1301	20.2158	20.2312	20.2314	20.1856	19.9253	19.3242	18.6749 (90)	
Living area fraction	f _{LA} = Living area / (4) =												0.3654 (91)
MIT	19.1018	19.4781	19.8603	20.2233	20.4115	20.4934	20.5098	20.5089	20.4634	20.2104	19.6430	19.0395 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.1018	19.4781	19.8603	20.2233	20.4115	20.4934	20.5098	20.5089	20.4634	20.2104	19.6430	19.0395 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8388	0.7755	0.6956	0.5732	0.4387	0.3047	0.2128	0.2379	0.3902	0.6153	0.7776	0.8525 (94)	
Ext temp.	510.6613	560.4253	563.4817	517.9664	421.7327	290.4419	194.7291	203.6145	309.9173	427.1715	476.2818	493.5463 (95)	
Heat loss rate W	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)	
Space heating kWh	769.6528	755.8687	690.7558	577.0960	442.6987	295.1445	195.8034	205.1707	320.5590	488.3764	641.1039	762.8585 (97)	
Space heating requirement - total per year (kWh/year)	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98a)	
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)	
Space heating requirement after solar contribution - total per year (kWh/year)	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98c)	
Space heating per m2	(98c) / (4) =												13.7946 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682	

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Space heating requirement	192.6897	131.3380	94.6920	42.5733	15.5987	0.0000	0.0000	0.0000	0.0000	45.5364	118.6719	200.3682 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027
Water heating fuel	249.8091	221.2737	235.6813	208.3513	202.8104	183.6379	181.7426	188.3651	189.8030	210.6114	222.7284	247.2027 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.8254	12.4875	13.8254	13.3795	13.8254	13.3795	13.8254	13.8254	13.3795	13.8254	13.3795	13.8254 (331)
Lighting	17.0777	13.7004	12.3357	9.0376	6.9809	5.7035	6.3682	8.2777	10.7519	14.1070	15.9339	17.5523 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												841.4682 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2542.0169 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												8.4147 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)												162.7833 (330a)
Total electricity for the above, kWh/year												162.7833 (331)
Electricity for lighting (calculated in Appendix L)												137.8268 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3684.0952 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	966.7100	0.1567	37.6657 (367)
Electrical energy for heat distribution (space & water)	8.4147	0.0000	4.8961 (372)
Overall CO2 factor for heat network			0.0428 (386)
Total CO2 associated with community systems			144.7844 (373)
Space and water heating			144.7844 (376)
Pumps, fans and electric keep-hot	162.7833	0.1387	22.5801 (378)
Energy for lighting	137.8268	0.1443	19.8927 (379)
Total CO2, kg/year			187.2571 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.0700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	966.7100	1.5800	379.8537 (467)
Electrical energy for heat distribution (space & water)	8.4147	0.0000	51.9442 (472)
Overall CO2 factor for heat network			0.4540 (486)
Total CO2 associated with community systems			1536.0651 (473)
Space and water heating			1536.0651 (476)
Pumps, fans and electric keep-hot	162.7833	1.5128	246.2586 (478)
Energy for lighting	137.8268	1.5338	211.4034 (479)
Total Primary energy kWh/year			1993.7271 (483)
Dwelling Primary energy Rate (DPER)			32.6800 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)

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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

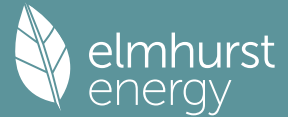
K1 Element	Length	Psi-value	Total
E16 Corner (normal)	12.6000	0.0900	1.1340
E17 Corner (inverted - internal area greater than external area)	5.0400	-0.0900	-0.4536
E1 Steel lintel with perforated steel base plate	10.2600	0.0500	0.5130
E3 Sill	9.3100	0.0500	0.4655
E4 Jamb	31.8000	0.0500	1.5900
E7 Party 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

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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												147.9356 162.0744 184.5269 (45)
Energy content (annual)												Total = Sum(45)m = 1804.0599
Distribution loss (46)m = 0.15 x (45)m												
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage												
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss												23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 (59)
Combi loss												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month												
	235.6854	208.5168	221.5575	194.6832	188.6866	169.9697	167.6188	174.2414	176.1348	196.4876	209.0602	233.0789 (62)
WWHRS												-26.4771 -23.4166 -24.5205 -20.3039 -18.9225 -16.1921 -15.1775 -16.1398 -16.7530 -19.7500 -22.3743 -25.9868 (63a)
PV diverter												-0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Solar input												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
FGHRS												0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h												
	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921 (64)
												Total per year (kWh/year) = Sum(64)m = 2129.7068 (64)
12Total per year (kWh/year)												2130 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month												
	101.0635	89.8333	96.3659	86.6980	85.4364	78.4808	78.4313	80.6333	80.5307	88.0302	91.4784	100.1968 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	88.5730	98.0630	88.5730	91.5254	88.5730	91.5254	88.5730	88.5730	91.5254	88.5730	91.5254	88.5730 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488 (69)
Pumps, fans												3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905 (71)
Water heating gains (Table 5)												
	135.8380	133.6805	129.5241	120.4139	114.8338	109.0011	105.4185	108.3781	111.8482	118.3202	127.0533	134.6731 (72)
Total internal gains												456.0192 465.1724 446.9378 431.0123 410.1497 392.6809 378.4040 379.5429 390.5536 406.8409 430.8566 447.1125 (73)

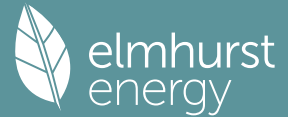
6. Solar gains												

[Jan]												
	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast	5.9000		36.7938		0.6300		0.7000		0.7700		66.3436 (77)	
Southwest	3.2000		36.7938		0.6300		0.7000		0.7700		35.9830 (79)	
Northwest	4.1500		11.2829		0.6300		0.7000		0.7700		14.3101 (81)	

Solar gains	116.6366	203.4285	290.9652	381.6822	446.8317	452.0968	432.3338	382.4304	322.1768	228.2360	140.5694	99.2565 (83)
Total gains	572.6558	668.6009	737.9031	812.6945	856.9814	844.7778	810.7378	761.9733	712.7305	635.0770	571.4260	546.3690 (84)

7. Mean internal temperature (heating season)												

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.9193	0.8808	0.8267	0.7298	0.6019	0.4537	0.3377	0.3717	0.5528	0.7645	0.8821	0.9275 (86)
MIT	19.1353	19.4736	19.8904	20.3715	20.7166	20.9093	20.9713	20.9616	20.8342	20.3838	19.6927	19.0734 (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	0.9085	0.8657	0.8050	0.6975	0.5563	0.3942	0.2679	0.2995	0.4918	0.7284	0.8646	0.9176 (89)
MIT 2	17.8695	18.2882	18.7997	19.3779	19.7680	19.9714	20.0242	20.0191	19.9024	19.4089	18.5744	17.7974 (90)
Living area fraction	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	fLA = Living area / (4) =			0.3654 (91)
MIT	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	20.2429	19.7651	18.9830	18.2637 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3321	18.7214	19.1982	19.7410	20.1146	20.3141	20.3703	20.3635	20.2429	19.7651	18.9830	18.2637 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8850	0.8417	0.7843	0.6870	0.5604	0.4117	0.2923	0.3242	0.5054	0.7174	0.8419	0.8949 (94)
Useful gains	506.8193	562.7864	578.7269	558.3296	480.2600	347.7898	236.9796	247.0540	360.2323	455.6144	481.0806	488.9702 (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	923.2749	907.4914	832.0190	703.3905	544.9582	366.8782	242.0761	254.0717	395.7263	593.5624	772.4563	917.7721 (97)
Space heating kWh	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98a)
Space heating requirement - total per year (kWh/year)												1513.9658
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	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1513.9658
Space heating per m2												(98c) / (4) = 24.8191 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	309.8430	231.6417	188.4494	104.4438	48.1354	0.0000	0.0000	0.0000	0.0000	102.6333	209.7905	319.0287 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	335.6912	250.9661	204.1705	113.1569	52.1511	0.0000	0.0000	0.0000	0.0000	111.1954	227.2919	345.6432 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	209.2083	185.1002	197.0371	174.3792	169.7641	153.7776	152.4413	158.1016	159.3818	176.7377	186.6859	207.0921 (64)
Efficiency of water heater	84.9389	84.5639	83.9599	82.9492	81.6276	79.8000	79.8000	79.8000	79.8000	82.8862	84.3221	79.8000 (216)
Fuel for water heating, kWh/month	246.3045	218.8879	234.6798	210.2242	207.9739	192.7037	191.0292	198.1223	199.7265	213.2294	221.3962	243.5649 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)	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)	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												

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Space heating fuel - main system 1	1640.2663 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2577.8427 (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	3849.6220 (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	1640.2663	0.2100	344.4559 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2577.8427	0.2100	541.3470 (264)
Space and water heating			885.8029 (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			840.8912 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.7900 (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	1640.2663	1.1300	1853.5009 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2577.8427	1.1300	2912.9622 (278)
Space and water heating			4766.4632 (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			4490.9779 (286)
Target Primary Energy Rate (TPER)			73.6200 (287)

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Property Reference	Flat 302 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 302 VL - Be Green	Prop Type Ref		Flat 302 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	82 B	DER	3.80	TER	18.47	
Environmental	97 A	% DER < TER				79.43
CO ₂ Emissions (t/year)	0.18	DFEE	43.81	TFEE	49.06	
Compliance Check	See BREL	% DFEE < TFEE				10.69
% DPER < TPER	59.19	DPER	40.40	TPER	98.99	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.8300 (2b)	= 146.1129 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.1129 (5)

2. Ventilation rate

	m ³ 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)

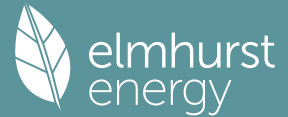
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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													
K1 Element													
E1 Steel lintel with perforated steel base plate													
E3 Sill													
E4 Jamb													
E7 Party floor between dwellings (in blocks of flats)													
E23 Balcony within or between dwellings, balcony support penetrates wall insulation													
E16 Corner (normal)													
E17 Corner (inverted - internal area greater than external area)													
E18 Party wall between dwellings													
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)													
P4 Party wall - Roof (insulation at ceiling level)													
E15 Flat roof with parapet													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													
Point Thermal bridges													
Total fabric heat loss													

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	48.1810	48.0409	47.9008	47.2001	47.0600	46.3593	46.3593	46.2192	46.6396	47.0600	47.3402	47.6205	(39)
	47.1651												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
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														
Hot water usage for baths														
Hot water usage for other uses														
Average daily hot water use (litres/day)														
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	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 content (annual)	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)	
Distribution loss (46)m = 0.15 x (45)m														
Water storage loss:														
Store volume														172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														1.6300 (48)
Temperature factor from Table 2b														0.7800 (49)
Enter (49) or (54) in (55)														1.2714 (55)
Total storage loss														
If cylinder contains dedicated solar storage														
Primary loss														
Combi loss														
Total heat required for water heating calculated for each month														
WwHRS														
PV diverter														
Solar input														
FGHRS														
Output from w/h														
12Total per year (kWh/year)														
Electric shower(s)														
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														

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		

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(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	78.9438	76.3972	78.9438	76.3972	78.9438	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	(71)
Water heating gains (Table 5)	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734	(72)
Total internal gains	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
Northwest				1.9800	11.2829	0.4700		0.7000	0.7700	5.0935 (81)		
Northeast				11.2800	11.2829	0.4700		0.7000	0.7700	29.0175 (75)		
Solar gains	34.1110	69.4340	125.0980	205.4469	276.1609	294.4167	275.4208	219.5687	152.4339	84.8539	42.9205	27.8568 (83)
Total gains	455.4932	498.5858	538.2743	604.3441	656.7266	662.1514	630.6248	575.9277	518.4973	462.7655	442.0688	441.4827 (84)

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, nil,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	0.8880	0.8591	0.8093	0.7055	0.5687	0.4178	0.3127	0.3528	0.5411	0.7467	0.8506	0.8945	(86)
MIT	19.0595	19.3242	19.7413	20.2922	20.6859	20.9014	20.9666	20.9535	20.7973	20.2957	19.6228	19.0263	(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	0.8767	0.8452	0.7905	0.6780	0.5310	0.3703	0.2570	0.2941	0.4905	0.7163	0.8338	0.8838	(89)
MIT 2	17.8752	18.2052	18.7217	19.3932	19.8481	20.0872	20.1478	20.1403	19.9849	19.4145	18.5908	17.8399	(90)
Living area fraction									fLA = Living area / (4) =			0.6328	(91)
MIT	18.6246	18.9133	19.3669	19.9620	20.3782	20.6024	20.6659	20.6548	20.4990	19.9721	19.2438	18.5906	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6246	18.9133	19.3669	19.9620	20.3782	20.6024	20.6659	20.6548	20.4990	19.9721	19.2438	18.5906	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8528	0.8222	0.7715	0.6713	0.5412	0.3954	0.2906	0.3287	0.5114	0.7090	0.8132	0.8603	(94)
Ext temp.	388.4649	409.9291	415.3035	405.7122	355.3994	261.8424	183.2624	189.3126	265.1413	328.0958	359.4692	379.8159	(95)
Heat loss rate W	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)
Space heating kWh	690.1722	673.2113	616.3326	522.1288	408.3972	278.2674	188.4944	196.6553	298.4468	441.0522	574.8897	685.2879	(97)
Space heating requirement - total per year (kWh/year)	224.4703	176.9257	149.5657	83.8199	39.4303	0.0000	0.0000	0.0000	0.0000	84.0395	155.1028	227.2711	(98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	224.4703	176.9257	149.5657	83.8199	39.4303	0.0000	0.0000	0.0000	0.0000	84.0395	155.1028	227.2711	(98c)
Space heating per m2										(98c) / (4) =		22.0923	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	224.4703	176.9257	149.5657	83.8199	39.4303	0.0000	0.0000	0.0000	0.0000	84.0395	155.1028	227.2711	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	224.4703	176.9257	149.5657	83.8199	39.4303	0.0000	0.0000	0.0000	0.0000	84.0395	155.1028	227.2711	

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Space heating requirement	224.4703	176.9257	149.5657	83.8199	39.4303	0.0000	0.0000	0.0000	0.0000	84.0395	155.1028	227.2711 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883
Water heating fuel	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	15.0186	13.5652	15.0186	14.5341	15.0186	14.5341	15.0186	15.0186	14.5341	15.0186	14.5341	15.0186 (331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1140.6252 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2400.1181 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												11.4063 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												176.8317 (330a)
Total electricity for the above, kWh/year												176.8317 (331)
Electricity for lighting (calculated in Appendix L)												135.8500 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3853.4249 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1011.6409	0.1551	50.5333 (367)
Electrical energy for heat distribution (space & water)	11.4063	0.0000	5.1456 (372)
Overall CO2 factor for heat network			0.0430 (386)
Total CO2 associated with community systems			152.1615 (373)
Space and water heating			152.1615 (376)
Pumps, fans and electric keep-hot	176.8317	0.1387	24.5287 (378)
Energy for lighting	135.8500	0.1443	19.6074 (379)
Total CO2, kg/year			196.2976 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1011.6409	1.5741	512.9796 (467)
Electrical energy for heat distribution (space & water)	11.4063	0.0000	54.4418 (472)
Overall CO2 factor for heat network			0.4547 (486)
Total CO2 associated with community systems			1609.9205 (473)
Space and water heating			1609.9205 (476)
Pumps, fans and electric keep-hot	176.8317	1.5128	267.5110 (478)
Energy for lighting	135.8500	1.5338	208.3713 (479)
Total Primary energy kWh/year			2085.8027 (483)
Dwelling Primary energy Rate (DPER)			40.4000 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

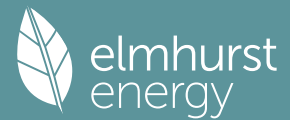
List of Thermal Bridges 81.6378 (35)

K1 Element	Length	Psi-value	Total
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

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	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1662.1611
25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019 (46)	
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)	
If cylinder contains dedicated solar storage												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120 (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 (61)	
Total heat required for water heating calculated for each month												
220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645 (62)	
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)	
												Total per year (kWh/year) = Sum(64)m =
12Total per year (kWh/year)												2007.1523 (64)
Electric shower(s)												2007 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
												0.0000 (64a)
Heat gains from water heating, kWh/month												
96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708 (65)	

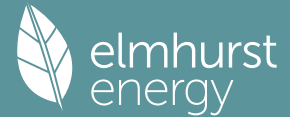
5. Internal gains (see Table 5 and 5a)

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)													
	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865	(72)
Total internal gains													
	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				9.3800	11.2829	0.6300	0.7000	0.7700	32.3442 (75)			
Northwest				1.6500	11.2829	0.6300	0.7000	0.7700	5.6896 (81)			
Solar gains	38.0338	77.4189	139.4842	229.0732	307.9193	328.2745	307.0941	244.8190	169.9637	94.6120	47.8564	31.0603 (83)
Total gains	447.3552	494.5234	540.5997	615.9138	676.4242	680.9526	647.2374	586.1173	520.9705	460.4629	434.9481	432.6254 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.9147	0.8933	0.8561	0.7768	0.6622	0.5239	0.4118	0.4598	0.6480	0.8144	0.8895	0.9199 (86)
MIT	17.8799	18.1928	18.7449	19.5231	20.2008	20.6641	20.8574	20.8147	20.4371	19.5847	18.6251	17.8298 (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	0.9036	0.8795	0.8368	0.7460	0.6141	0.4522	0.3172	0.3634	0.5809	0.7817	0.8729	0.9094 (89)
MIT 2	16.2283	16.6188	17.3056	18.2580	19.0525	19.5612	19.7425	19.7132	19.3434	18.3578	17.1718	16.1686 (90)
Living area fraction									fLA = Living area / (4) =			0.6328 (91)
MIT	17.2734	17.6148	18.2163	19.0585	19.7791	20.2591	20.4480	20.4102	20.0354	19.1341	18.0914	17.2198 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2734	17.6148	18.2163	19.0585	19.7791	20.2591	20.4480	20.4102	20.0354	19.1341	18.0914	17.2198 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8724	0.8470	0.8052	0.7235	0.6125	0.4802	0.3692	0.4135	0.5943	0.7594	0.8421	0.8789 (94)
Useful gains	390.2628	418.8624	435.2758	445.6380	414.3429	326.9664	238.9400	242.3523	309.6128	349.6830	366.2720	380.2243 (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	907.2777	887.4505	816.1900	701.2692	556.7714	386.8915	263.0726	273.7563	407.0385	588.1292	760.0922	903.6052 (97)
Space heating kWh	384.6591	314.8912	283.4002	184.0545	105.9668	0.0000	0.0000	0.0000	0.0000	177.4040	283.5506	389.3954 (98a)
Space heating requirement - total per year (kWh/year)												2123.3218
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	384.6591	314.8912	283.4002	184.0545	105.9668	0.0000	0.0000	0.0000	0.0000	177.4040	283.5506	389.3954 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2123.3218
Space heating per m2										(98c) / (4) =		41.1257 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	384.6591	314.8912	283.4002	184.0545	105.9668	0.0000	0.0000	0.0000	0.0000	177.4040	283.5506	389.3954 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	416.7487	341.1606	307.0425	199.4089	114.8070	0.0000	0.0000	0.0000	0.0000	192.2036	307.2054	421.8802 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
Efficiency of water heater (217)m	85.5374	85.3733	85.0089	84.3142	83.1549	79.8000	79.8000	79.8000	79.8000	84.2002	85.1270	79.8000 (216)
Fuel for water heating, kWh/month	229.8069	203.7991	218.0450	194.9361	192.6885	182.1778	180.7890	187.3239	188.6473	197.9263	206.3939	227.4051 (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)												

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(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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													2300.4570	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													79.8000	
Water heating fuel used													2409.9392	(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													4414.3301	(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	2300.4570	0.2100	483.0960	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2409.9392	0.2100	506.0872	(264)
Space and water heating			989.1832	(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			953.3691	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.4700	(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	2300.4570	1.1300	2599.5164	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2409.9392	1.1300	2723.2313	(278)
Space and water heating			5322.7476	(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			5110.6458	(286)
Target Primary Energy Rate (TPER)			98.9900	(287)

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Property Reference	Flat 302 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 302 WCS - Green		Prop Type Ref	Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	83 B	DER	3.41	TER	15.66	
Environmental	98 A	% DER < TER				78.22
CO ₂ Emissions (t/year)	0.16	DFEE	37.03	TFEE	36.62	
Compliance Check	See BREL	% DFEE < TFEE				-1.11
% DPER < TPER	56.73	DPER	36.30	TPER	83.89	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.0000 (1b)	x 2.5200 (2b)	= 131.0400 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 131.0400 (5)

2. Ventilation rate

	m ³ 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)

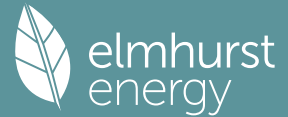
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 5005.4200 (34)
 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			0.0000 (36a)				
Total fabric heat loss			38.6316 (37)				

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)	
Average = Sum(39)m / 12 =	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)	
												47.4596	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)	
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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1667.8640	
25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)	
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)	
If cylinder contains dedicated solar storage													
39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)	
12Total per year (kWh/year)													2405.8210 (64)
Electric shower(s)													2406 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				12.4200	36.7938	0.4700	0.7000	0.7700	104.1899 (77)			
Southeast				2.0500	36.7938	0.4700	0.7000	0.7700	17.1972 (77)			
Southwest				2.0500	36.7938	0.4700	0.7000	0.7700	17.1972 (79)			

Solar gains	138.5844	236.0604	322.9882	400.1980	448.2551	445.0136	429.0406	393.1878	349.7279	260.8971	165.9921	118.5993 (83)
Total gains	561.8387	667.1394	738.0015	800.8662	830.4905	814.3523	785.7788	751.0805	717.3771	640.4523	566.8952	534.0513 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.8608	0.7986	0.7240	0.6134	0.4888	0.3554	0.2581	0.2806	0.4275	0.6427	0.8012	0.8738 (86)
MIT	19.5897	19.9375	20.2878	20.6348	20.8486	20.9572	20.9877	20.9840	20.9230	20.6449	20.0914	19.5261 (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	0.8466	0.7801	0.7003	0.5831	0.4518	0.3123	0.2106	0.2317	0.3814	0.6074	0.7799	0.8607 (89)
MIT 2	18.5192	18.9424	19.3639	19.7764	20.0152	20.1349	20.1612	20.1606	20.1005	19.7998	19.1466	18.4473 (90)
Living area fraction	fLA = Living area / (4) =											0.6488 (91)
MIT	19.2138	19.5881	19.9634	20.3334	20.5560	20.6684	20.6975	20.6948	20.6342	20.3482	19.7597	19.1473 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2138	19.5881	19.9634	20.3334	20.5560	20.6684	20.6975	20.6948	20.6342	20.3482	19.7597	19.1473 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8291	0.7670	0.6949	0.5896	0.4695	0.3384	0.2410	0.2628	0.4076	0.6156	0.7691	0.8429	(94)
Useful gains	465.8178	511.6967	512.8658	472.2280	389.9398	275.5524	189.3491	197.3514	292.4385	394.2824	435.9850	450.1439	(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													
	721.3903	708.6269	647.8497	542.9833	419.4659	283.6208	191.5034	200.1882	307.0312	461.7252	602.8111	715.4968	(97)
Space heating kWh													
	190.1459	132.3371	100.4280	50.9438	21.9674	0.0000	0.0000	0.0000	0.0000	50.1774	120.1148	197.4225	(98a)
Space heating requirement - total per year (kWh/year)													863.5371
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													
	190.1459	132.3371	100.4280	50.9438	21.9674	0.0000	0.0000	0.0000	0.0000	50.1774	120.1148	197.4225	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													863.5371
Space heating per m2													(98c) / (4) =
													16.6065 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	190.1459	132.3371	100.4280	50.9438	21.9674	0.0000	0.0000	0.0000	0.0000	50.1774	120.1148	197.4225 (98)

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Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	190.1459	132.3371	100.4280	50.9438	21.9674	0.0000	0.0000	0.0000	0.0000	50.1774	120.1148	197.4225	
Space heating requirement													
	190.1459	132.3371	100.4280	50.9438	21.9674	0.0000	0.0000	0.0000	0.0000	50.1774	120.1148	197.4225	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating													
Annual water heating requirement													
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	
Water heating fuel													
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(310)
Cooling System Energy Efficiency Ratio													0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	11.7856	10.6451	11.7856	11.4054	11.7856	11.4054	11.7856	11.7856	11.4054	11.7856	11.4054	11.7856	11.7856 (331)
Lighting	15.5992	12.5143	11.2677	8.2552	6.3766	5.2097	5.8169	7.5610	9.8210	12.8857	14.5544	16.0328	16.0328 (332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year													
Space heating fuel - community heating													863.5371 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2405.8210 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													8.6354 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)													
mechanical ventilation fans (SFP = 0.8680)													138.7661 (330a)
Total electricity for the above, kWh/year													138.7661 (331)
Electricity for lighting (calculated in Appendix L)													125.8946 (332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (333)
Wind generation													0.0000 (334)
Hydro-electric generation (Appendix N)													0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (335)
Appendix Q - special features													
Energy saved or generated													-0.0000 (336)
Energy used													0.0000 (337)
Total delivered energy for all uses													3534.0188 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	934.1023	0.1562	38.5312	(367)
Electrical energy for heat distribution (space & water)	8.6354	0.0000	4.7336	(372)
Overall CO2 factor for heat network			0.0428	(386)
Total CO2 associated with community systems			139.9781	(373)
Space and water heating			139.9781	(376)
Pumps, fans and electric keep-hot	138.7661	0.1387	19.2486	(378)
Energy for lighting	125.8946	0.1443	18.1705	(379)
Total CO2, kg/year			177.3972	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4100	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	934.1023	1.5781	389.3654	(467)
Electrical energy for heat distribution (space & water)	8.6354	0.0000	50.2021	(472)
Overall CO2 factor for heat network			0.4541	(486)
Total CO2 associated with community systems			1484.5492	(473)
Space and water heating			1484.5492	(476)
Pumps, fans and electric keep-hot	138.7661	1.5128	209.9254	(478)
Energy for lighting	125.8946	1.5338	193.1013	(479)
Total Primary energy kWh/year			1887.5759	(483)
Dwelling Primary energy Rate (DPER)			36.3000	(484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (U _w = 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 A _{um} (A, m ²)			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)

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Average = Sum(39)m / 12 =												60.3160
HLP	Jan 1.1768	Feb 1.1742	Mar 1.1717	Apr 1.1599	May 1.1577	Jun 1.1475	Jul 1.1475	Aug 1.1456	Sep 1.1514	Oct 1.1577	Nov 1.1622	Dec 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)

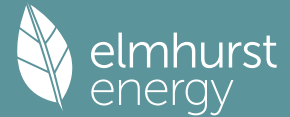
Daily hot water use	Jan 109.2375	Feb 106.9057	Mar 104.0656	Apr 99.7460	May 96.2386	Jun 92.4676	Jul 91.0178	Aug 93.8456	Sep 96.8281	Oct 100.7870	Nov 105.1731	Dec 108.9541 (44)
Energy conte	173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384	170.5958 (45)
Energy content (annual)										Total = Sum(45)m =		1667.8640
Distribution loss (46)m = 0.15 x (45)m	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Total per year (kWh/year)												2012.0777 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 87.4535	Feb 87.4535	Mar 87.4535	Apr 87.4535	May 87.4535	Jun 87.4535	Jul 87.4535	Aug 87.4535	Sep 87.4535	Oct 87.4535	Nov 87.4535	Dec 87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0499	85.3052	77.0499	79.6182	77.0499	79.6182	77.0499	77.0499	79.6182	77.0499	79.6182	77.0499 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472 (72)
Total internal gains	411.2360	419.0786	402.9950	388.6554	370.2170	354.3259	341.7199	342.8743	352.6365	367.5369	388.8904	403.4336 (73)

6. Solar gains												
[Jan]												
		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast		9.6400		36.7938		0.6300		0.7000		0.7700		108.3987 (77)
Southwest		1.3700		36.7938		0.6300		0.7000		0.7700		15.4052 (79)

Solar gains	123.8039	210.8838	288.5404	357.5155	400.4472	397.5513	383.2819	351.2530	312.4282	233.0715	148.2885	105.9503 (83)
Total gains	535.0399	629.9624	691.5353	746.1710	770.6642	751.8773	725.0018	694.1273	665.0647	600.6084	537.1788	509.3839 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.9060	0.8635	0.8093	0.7204	0.6049	0.4643	0.3469	0.3748	0.5425	0.7438	0.8653	0.9151 (86)
MIT	18.9789	19.3465	19.7796	20.2726	20.6451	20.8754	20.9581	20.9473	20.8014	20.3207	19.5814	18.9116 (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	0.8934	0.8463	0.7856	0.6863	0.5569	0.4002	0.2704	0.2971	0.4785	0.7049	0.8454	0.9036 (89)
MIT 2	17.6263	18.0793	18.6090	19.2020	19.6250	19.8693	19.9401	19.9342	19.8003	19.2750	18.3860	17.5481 (90)
Living area fraction									fLA = Living area / (4) =			0.6488 (91)
MIT	18.5040	18.9015	19.3685	19.8966	20.2869	20.5221	20.6006	20.5916	20.4498	19.9535	19.1616	18.4328 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5040	18.9015	19.3685	19.8966	20.2869	20.5221	20.6006	20.5916	20.4498	19.9535	19.1616	18.4328 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8727	0.8267	0.7712	0.6844	0.5728	0.4355	0.3181	0.3449	0.5096	0.7049	0.8280	0.8832 (94)
Useful gains	466.9217	520.8024	533.3354	510.6711	441.4284	327.4415	230.6280	239.4009	338.9197	423.3680	444.8040	449.9105 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	869.1620	854.9140	784.0599	663.2796	516.9476	353.3666	238.7154	249.6934	380.1927	563.1011	728.9274	863.5872 (97)
Space heating kWh	299.2668	224.5229	186.5390	109.8782	56.1863	0.0000	0.0000	0.0000	0.0000	103.9615	204.5688	307.7755 (98a)
Space heating requirement - total per year (kWh/year)												1492.6990
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	299.2668	224.5229	186.5390	109.8782	56.1863	0.0000	0.0000	0.0000	0.0000	103.9615	204.5688	307.7755 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1492.6990
Space heating per m2										(98c) / (4) =		28.7058 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	299.2668	224.5229	186.5390	109.8782	56.1863	0.0000	0.0000	0.0000	0.0000	103.9615	204.5688	307.7755 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	324.2327	243.2535	202.1008	119.0446	60.8736	0.0000	0.0000	0.0000	0.0000	112.6343	221.6347	333.4512 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	84.9939	84.6269	84.0684	83.1725	81.9526	79.8000	79.8000	79.8000	79.8000	83.0279	84.3962	79.8000 (216)
Fuel for water heating, kWh/month	231.8740	206.1240	221.0428	198.0961	195.9830	182.6008	181.2006	187.7579	189.0926	201.2090	208.7043	229.3476 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)												

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(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)	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												1617.2254	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2433.0328	(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												3751.4175	(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	1617.2254	0.2100	339.6173 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2433.0328	0.2100	510.9369 (264)
Space and water heating			850.5542 (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			814.3932 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1617.2254	1.1300	1827.4647 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2433.0328	1.1300	2749.3271 (278)
Space and water heating			4576.7918 (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			4362.3064 (286)
Target Primary Energy Rate (TPER)			83.8900 (287)

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Property Reference	Flat 303 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 303 VL - Be Green		Prop Type Ref	Flat 203 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	84 B	DER	3.31	TER	15.14	
Environmental	98 A	% DER < TER				78.14
CO ₂ Emissions (t/year)	0.16	DFEE	33.38	TFEE	34.14	
Compliance Check	See BREL	% DFEE < TFEE				2.23
% DPER < TPER	56.42	DPER	35.35	TPER	81.11	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.6300 (1b)	x 2.8300 (2b)	= 146.1129 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6300		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.1129 (5)

2. Ventilation rate

	m ³ 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)

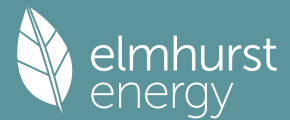
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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							
K1 Element	Length	Psi-value	Total				
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	37.4660	37.3259	37.1858	36.4851	36.3450	35.6443	35.6443	35.5042	35.9246	36.3450	36.6252	36.9055	(39)
													36.4501
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

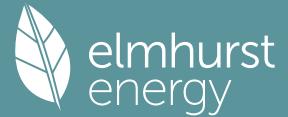
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7382 (42)
Hot water usage for mixer showers													
Hot water usage for baths	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 other uses	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)
Average daily hot water use (litres/day)	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)
													100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
Primary loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
Total per year (kWh/year)	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
Electric shower(s)													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	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)
Heat gains from water heating, kWh/month	107.4683	95.7325	103.1405	93.7699	93.0706	86.1991	86.6165	88.6452	88.0875	95.4602	98.1741	106.6698	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
	151.4660	153.0378	149.0770	140.6451	130.0013	119.9976	113.3145	111.7427	115.7035	124.1354	134.7793	144.7830 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908	31.6908 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262	-69.5262 (71)
Water heating gains (Table 5)	144.4466	142.4590	138.6297	130.2360	125.0949	119.7210	116.4200	119.1468	122.3438	128.3067	136.3529	143.3734 (72)
Total internal gains	421.3822	429.1518	413.1763	398.8972	380.5657	367.7347	355.2040	356.3590	366.0634	377.9117	399.1483	413.6259 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)
Northeast	11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)

Solar gains	45.6275	87.3590	145.1299	222.7349	288.6497	303.7910	285.7172	233.9078	171.5888	103.4531	56.4065	37.9119 (83)
Total gains	467.0097	516.5108	558.3061	621.6321	669.2154	671.5257	640.9212	590.2669	537.6522	481.3648	455.5548	451.5377 (84)

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, n _{l1} ,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	0.8813	0.8390	0.7706	0.6373	0.4843	0.3358	0.2438	0.2751	0.4469	0.6837	0.8277	0.8896 (86)
MIT	20.0266	20.2374	20.5035	20.7925	20.9361	20.9879	20.9972	20.9957	20.9649	20.7759	20.3958	20.0033 (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	0.8696	0.8243	0.7509	0.6112	0.4535	0.3027	0.2081	0.2369	0.4078	0.6536	0.8099	0.8787 (89)
MIT 2	19.1863	19.4456	19.7689	20.1160	20.2760	20.3395	20.3476	20.3489	20.3145	20.1062	19.6534	19.1651 (90)
Living area fraction	f _{LA} = Living area / (4) =											0.6328 (91)
MIT	19.7180	19.9466	20.2337	20.5441	20.6937	20.7498	20.7587	20.7582	20.7261	20.5300	20.1232	19.6955 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7180	19.9466	20.2337	20.5441	20.6937	20.7498	20.7587	20.7582	20.7261	20.5300	20.1232	19.6955 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8582	0.8155	0.7482	0.6196	0.4702	0.3231	0.2305	0.2609	0.4307	0.6626	0.8040	0.8672 (94)
Useful gains	400.7649	421.2310	417.7242	385.1613	314.6554	216.9832	147.7643	153.9920	231.5590	318.9557	366.2572	391.5602 (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	577.6524	561.6283	510.7001	424.8366	326.8768	219.2042	148.2327	154.7327	238.0385	360.9044	476.9767	571.8685 (97)
Space heating kWh	131.6043	94.3469	69.1741	28.5662	9.0927	0.0000	0.0000	0.0000	0.0000	31.2098	79.7180	134.1494 (98a)
Space heating requirement - total per year (kWh/year)												577.8615
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	131.6043	94.3469	69.1741	28.5662	9.0927	0.0000	0.0000	0.0000	0.0000	31.2098	79.7180	134.1494 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												577.8615
Space heating per m2												(98c) / (4) = 11.1924 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	131.6043	94.3469	69.1741	28.5662	9.0927	0.0000	0.0000	0.0000	0.0000	31.2098	79.7180	134.1494 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	131.6043	94.3469	69.1741	28.5662	9.0927	0.0000	0.0000	0.0000	0.0000	31.2098	79.7180	134.1494
Space heating requirement	131.6043	94.3469	69.1741	28.5662	9.0927	0.0000	0.0000	0.0000	0.0000	31.2098	79.7180	134.1494 (307)

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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating													
Annual water heating requirement	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	
Water heating fuel													
	235.0898	208.3221	222.0739	196.7344	191.7884	173.9650	172.3776	178.4790	179.6444	198.9751	209.9801	232.6883	(310)
Cooling System Energy Efficiency Ratio													0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	15.0186	13.5652	15.0186	14.5341	15.0186	14.5341	15.0186	15.0186	14.5341	15.0186	14.5341	15.0186	15.0186 (331)
Lighting	16.8328	13.5039	12.1587	8.9080	6.8808	5.6217	6.2769	8.1589	10.5977	13.9047	15.7053	17.3006	17.3006 (332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year													
Space heating fuel - community heating													577.8615 (307)
Space heating fuel - secondary													0.0000 (309)
Water heating fuel - community heating													2400.1181 (310)
Efficiency of water heater													0.0000 (311)
Electricity used for heat distribution													5.7786 (313)
Space cooling fuel													0.0000 (321)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)													
mechanical ventilation fans (SFP = 0.9920)													176.8317 (330a)
Total electricity for the above, kWh/year													176.8317 (331)
Electricity for lighting (calculated in Appendix L)													135.8500 (332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (333)
Wind generation													0.0000 (334)
Hydro-electric generation (Appendix N)													0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (335)
Appendix Q - special features													
Energy saved or generated													-0.0000 (336)
Energy used													0.0000 (337)
Total delivered energy for all uses													3290.6612 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	850.8513	0.1567	25.8755	(367)
Electrical energy for heat distribution (space & water)	5.7786	0.0000	4.2825	(372)
Overall CO2 factor for heat network			0.0425	(386)
Total CO2 associated with community systems			126.6407	(373)
Space and water heating			126.6407	(376)
Pumps, fans and electric keep-hot	176.8317	0.1387	24.5287	(378)
Energy for lighting	135.8500	0.1443	19.6074	(379)
Total CO2, kg/year			170.7768	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3100	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	850.8513	1.5802	260.8951	(467)
Electrical energy for heat distribution (space & water)	5.7786	0.0000	45.6188	(472)
Overall CO2 factor for heat network			0.4530	(486)
Total CO2 associated with community systems			1349.0130	(473)
Space and water heating			1349.0130	(476)
Pumps, fans and electric keep-hot	176.8317	1.5128	267.5110	(478)
Energy for lighting	135.8500	1.5338	208.3713	(479)
Total Primary energy kWh/year			1824.8952	(483)
Dwelling Primary energy Rate (DPER)			35.3500	(484)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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)

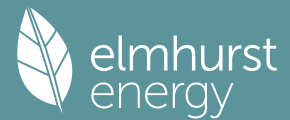
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3823	0.3748	0.3673	0.3298	0.3223	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							112.6378 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												53.0793
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7382 (42)
Hot water usage for mixer showers	53.3626	52.5607	51.3921	49.1563	47.5062	45.6662	44.6203	45.7800	47.0513	49.0270	51.3109	53.1582 (42a)
Hot water usage for baths	23.0709	22.7283	22.2458	21.3561	20.6900	19.9513	19.5523	20.0314	20.5531	21.3435	22.2515	22.9929 (42b)
Hot water usage for other uses	32.4304	31.2512	30.0719	28.8926	27.7133	26.5340	26.5340	27.7133	28.8926	30.0719	31.2512	32.4304 (42c)
Average daily hot water use (litres/day)												100.0712 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	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)
Water storage loss:												1662.1611
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.8621	22.7568	23.9097	20.4121	19.3669	16.9966	16.4553	17.3705	17.8486	20.4449	22.3989	25.5019 (46)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	220.9660	195.5652	207.9501	183.0663	177.6647	160.2968	158.2538	164.3552	165.9763	184.8514	196.3119	218.5645 (62)
WWHRS	-24.3952	-21.5753	-22.5924	-18.7074	-17.4346	-14.9189	-13.9841	-14.8707	-15.4357	-18.1970	-20.6150	-23.9434 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
12Total per year (kWh/year)												2007.1523 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	96.1693	85.5269	91.8415	82.8354	81.7716	75.2646	75.3175	77.3462	77.1530	84.1612	87.2396	95.3708 (65)

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	3.0000	3.0000	3.0000	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)	129.2598	127.2722	123.4428	115.0492	109.9080	104.5341	101.2331	103.9599	107.1569	113.1198	121.1661	128.1865 (72)
Total internal gains	409.3215	417.1045	401.1155	386.8407	368.5049	352.6781	340.1433	341.2983	351.0068	365.8509	387.0918	401.5651 (73)

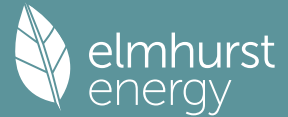
6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			9.3800	11.2829	0.6300	0.7000	0.7700	32.3442 (75)				
Southeast			1.6500	36.7938	0.6300	0.7000	0.7700	18.5537 (77)				
Solar gains	50.8980	97.4415	161.8602	248.3843	321.8695	338.7458	318.5953	260.8361	191.3602	115.3878	62.9205	42.2920 (83)
Total gains	460.2194	514.5460	562.9758	635.2249	690.3745	691.4239	658.7386	602.1344	542.3670	481.2387	450.0123	443.8572 (84)

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, nil,m (see Table 9a)	

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	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	0.9299	0.9030	0.8563	0.7559	0.6148	0.4562	0.3407	0.3848	0.5883	0.8003	0.8992	0.9358 (86)
MIT	19.2013	19.4707	19.8710	20.3807	20.7395	20.9232	20.9764	20.9656	20.8313	20.3666	19.7217	19.1606 (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	0.9201	0.8899	0.8370	0.7250	0.5697	0.3977	0.2722	0.3124	0.5272	0.7671	0.8835	0.9268 (89)
MIT 2	17.9667	18.3026	18.7974	19.4135	19.8187	20.0129	20.0579	20.0526	19.9292	19.4144	18.6286	17.9214 (90)
Living area fraction	18.7480	19.0417	19.4768	20.0255	20.4014	20.5889	20.6391	20.6303	20.5000	20.0169	19.3203	18.7055 (92)
MIT	18.7480	19.0417	19.4768	20.0255	20.4014	20.5889	20.6391	20.6303	20.5000	20.0169	19.3203	18.7055 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7480	19.0417	19.4768	20.0255	20.4014	20.5889	20.6391	20.6303	20.5000	20.0169	19.3203	18.7055 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9039	0.8736	0.8239	0.7237	0.5865	0.4308	0.3145	0.3564	0.5565	0.7653	0.8690	0.9110 (94)
Useful gains	415.9773	449.5040	463.8437	459.7371	404.9265	297.8883	207.1753	214.6298	301.8109	368.3093	391.0714	404.3383 (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	779.9106	761.4456	696.9786	590.5428	460.8413	313.8987	211.7022	221.2960	336.7980	498.7382	650.1240	775.3154 (97)
Space heating kWh	270.7664	209.6247	173.4523	94.1801	41.6006	0.0000	0.0000	0.0000	0.0000	97.0391	186.5179	276.0070 (98a)
Space heating requirement - total per year (kWh/year)												1349.1880
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	270.7664	209.6247	173.4523	94.1801	41.6006	0.0000	0.0000	0.0000	0.0000	97.0391	186.5179	276.0070 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1349.1880
Space heating per m2										(98c) / (4) =		26.1319 (99)

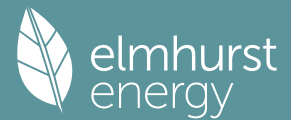
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	270.7664	209.6247	173.4523	94.1801	41.6006	0.0000	0.0000	0.0000	0.0000	97.0391	186.5179	276.0070 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	293.3547	227.1124	187.9223	102.0369	45.0711	0.0000	0.0000	0.0000	0.0000	105.1344	202.0779	299.0325 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating												
Water heating requirement	196.5708	173.9899	185.3577	164.3589	160.2300	145.3779	144.2697	149.4845	150.5406	166.6544	175.6969	194.6211 (64)
Efficiency of water heater (217)m	84.7783	84.4787	83.9112	82.8592	81.5026	79.8000	79.8000	79.8000	79.8000	82.8916	84.1941	79.8000 (216)
Fuel for water heating, kWh/month	231.8646	205.9571	220.8975	198.3593	196.5950	182.1778	180.7890	187.3239	188.6473	201.0509	208.6809	229.3897 (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												1461.7422 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	79.8000
Water heating fuel used	2431.7332 (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	3597.4093 (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	1461.7422	0.2100	306.9659 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2431.7332	0.2100	510.6640 (264)
Space and water heating			817.6298 (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			781.8157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.1400 (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	1461.7422	1.1300	1651.7686 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2431.7332	1.1300	2747.8585 (278)
Space and water heating			4399.6272 (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			4187.5253 (286)
Target Primary Energy Rate (TPER)			81.1100 (287)

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Property Reference	Flat 303 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 303 WCS - Green	Prop Type Ref	Flat 102 WCS - Green			
Property	West Central Street, London, WC1A					
SAP Rating	85 B	DER	2.83	TER	12.20	
Environmental	98 A	% DER < TER				76.80
CO ₂ Emissions (t/year)	0.2	DFEE	29.56	TFEE	29.79	
Compliance Check	See BREL	% DFEE < TFEE				0.79
% DPER < TPER	53.17	DPER	30.41	TPER	64.93	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.0000 (1b)	x 2.5200 (2b)	= 186.4800 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.4800 (5)

2. Ventilation rate

	m ³ 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)

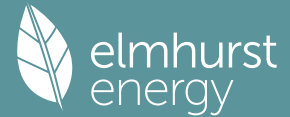
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9799 (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	0.0000	20.0000	191.6000	(32)
Corridor Wall	34.0200	0.0000	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) = 7446.2799 (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						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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	13.8596	13.6808	13.5019	12.6077	12.4288	11.5346	11.5346	11.3558	11.8923	12.4288	12.7865	13.1442	
Average = Sum(39)m / 12 =	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)
													52.4690
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in month	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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1976.1681
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072	(62)
WVHRS	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	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2714.1251 (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)
Heat gains from water heating, kWh/month	118.2986	105.2621	113.1527	102.3175	101.1804	93.3163	93.5072	95.9193	95.5620	104.0220	107.5542	117.3493	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	116.9597	

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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	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	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)	-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)	159.0035	156.6400	152.0869	142.1076	135.9951	129.6060	125.6817	128.9238	132.7250	139.8145	149.3808	157.7276 (72)
Total internal gains	527.6676	538.6031	517.4949	499.4938	475.4029	458.8497	442.3455	443.4453	456.1160	471.2271	498.7719	517.2827 (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	680.1945	805.6074	901.9321	1007.8620	1074.0547	1066.0329	1022.3829	954.1609	883.1618	771.4764	682.7741	646.9661 (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, n _{l,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	0.8746	0.8073	0.7187	0.5808	0.4388	0.3060	0.2207	0.2461	0.3958	0.6326	0.8100	0.8877 (86)
MIT	20.0258	20.3164	20.5935	20.8381	20.9502	20.9901	20.9978	20.9967	20.9744	20.8176	20.4199	19.9770 (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	0.8625	0.7911	0.6978	0.5552	0.4101	0.2754	0.1881	0.2115	0.3601	0.6022	0.7915	0.8767 (89)
MIT 2	19.1849	19.5392	19.8716	20.1628	20.2868	20.3372	20.3437	20.3451	20.3191	20.1480	19.6797	19.1319 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.6284	19.9491	20.2524	20.5190	20.6367	20.6816	20.6887	20.6887	20.6648	20.5012	20.0701	19.5776 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6284	19.9491	20.2524	20.5190	20.6367	20.6816	20.6887	20.6887	20.6648	20.5012	20.0701	19.5776 (93)

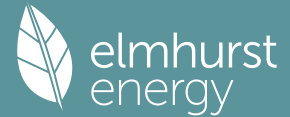
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8490	0.7817	0.6955	0.5625	0.4232	0.2912	0.2052	0.2296	0.3778	0.6100	0.7838	0.8630 (94)
Ext temp.	577.5144	629.7753	627.3191	566.8881	454.5602	310.4068	209.8284	219.0963	333.6233	470.6148	535.1460	558.3409 (95)
Heat loss rate W	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)
Space heating kWh	824.1404	806.4350	734.4853	610.1547	467.6999	312.8396	210.3245	219.8487	340.0430	518.1765	683.4281	815.7874 (97)
Space heating requirement - total per year (kWh/year)	183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98a)
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)
Space heating contribution - total per year (kWh/year)	183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	(98c) / (4) =											
Space heating per m2	10.2237 (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	0.9780	0.9882	0.9842	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	472.9277	376.1656	383.4362	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1189.1146	1140.4734	1061.9363	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	515.6545	568.6450	504.8040	0.0000	0.0000	0.0000	0.0000 (104)

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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	128.9136	142.1613	126.2010	0.0000	0.0000	0.0000 (107)
Space cooling requirement											397.2759 (107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402	
307a												
Space heating requirement												
183.4898	118.7153	79.7316	31.1520	9.7759	0.0000	0.0000	0.0000	0.0000	35.3859	106.7631	191.5402 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	

Water heating

Annual water heating requirement	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072
310a	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072
Water heating fuel	267.6622	236.9826	252.1857	222.4414	216.1788	195.3701	193.1014	200.3560	202.1241	224.7249	238.1907	264.8072 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	31.9885	35.2757	31.3154	0.0000	0.0000	0.0000	4.0300 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	31.9885	35.2757	31.3154	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	16.7718	15.1488	16.7718	16.2308	16.7718	16.2308	16.7718	16.2308	16.7718	16.2308	16.7718	16.7718 (331)
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 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating											756.5538 (307)	
Space heating fuel - secondary											0.0000 (309)	
Water heating fuel - community heating											2714.1251 (310)	
Efficiency of water heater											0.0000 (311)	
Electricity used for heat distribution											7.5655 (313)	
Space cooling fuel											98.5796 (321)	

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)											
mechanical ventilation fans (SFP = 0.8680)											197.4749 (330a)
Total electricity for the above, kWh/year											197.4749 (331)
Electricity for lighting (calculated in Appendix L)											154.3899 (332)

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

PV generation											0.0000 (333)
Wind generation											0.0000 (334)
Hydro-electric generation (Appendix N)											0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)											0.0000 (335)
Appendix Q - special features											
Energy saved or generated											-0.0000 (336)
Energy used											0.0000 (337)
Total delivered energy for all uses											3921.1234 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	991.6226	0.1573	34.0006 (367)
Electrical energy for heat distribution (space & water)	7.5655	0.0000	5.0115 (372)
Overall CO2 factor for heat network			0.0427 (386)
Total CO2 associated with community systems			148.1966 (373)
Space and water heating			148.1966 (376)
Space cooling	98.5796	0.1142	11.2616 (377)
Pumps, fans and electric keep-hot	197.4749	0.1387	27.3922 (378)
Energy for lighting	154.3899	0.1443	22.2832 (379)
Total CO2, kg/year			209.1336 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.8300 (384)

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13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	991.6226	1.5823	342.0201	(467)
Electrical energy for heat distribution (space & water)	7.5655	0.0000	53.2422	(472)
Overall CO2 factor for heat network			0.4536	(486)
Total CO2 associated with community systems			1574.4477	(473)
Space and water heating			1574.4477	(476)
Space cooling	98.5796	1.4210	140.0829	(477)
Pumps, fans and electric keep-hot	197.4749	1.5128	298.7400	(478)
Energy for lighting	154.3899	1.5338	236.8084	(479)
Total Primary energy kWh/year			2250.0789	(483)
Dwelling Primary energy Rate (DPER)			30.4100	(484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
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

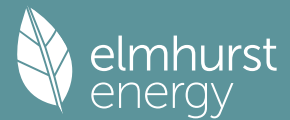
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans	Air changes per hour	
Pressure test	30.0000 / (5) =	0.1609 (8)
Pressure Test Method		Yes
Measured/design AP50		Blower Door
Infiltration rate		5.0000 (17)
Number of sides sheltered		0.4109 (18)
		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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

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

110.6254 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	10.0800	0.0900	0.9072
E16 Corner (normal)	2.5200	-0.0900	-0.2268
E17 Corner (inverted - internal area greater than external area)	2.5200	0.0600	0.1512
E18 Party wall between dwellings	4.8600	0.0200	0.0972
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	11.3900	0.0500	0.5695
E1 Steel lintel with perforated steel base plate	10.4400	0.0500	0.5220
E3 Sill	41.0000	0.0500	2.0500
E4 Jamb	54.4400	0.0700	3.8108
E7 Party floor between dwellings (in blocks of flats)	34.6000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)			7.8811 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			0.0000
Point Thermal bridges		(36a) =	
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
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

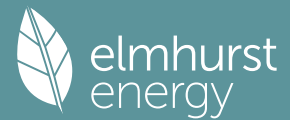
4. Water heating energy requirements (kWh/year)

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 content (annual)	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)
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:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	253.5384	224.2257	238.0619	208.7732	202.0550	181.7019	178.9777	186.2323	188.4560	210.6011	224.5225	250.6834 (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	224.5362	198.5758	211.2029	186.5329	181.3278	163.9655	162.3526	168.5532	170.1052	188.9676	200.0144	222.2182 (64)
	Total per year (kWh/year) = Sum(64)m =											2278.3524 (64)
12Total per year (kWh/year)												2278 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	106.9996	95.0565	101.8537	91.3830	89.8814	82.3818	82.2081	84.6203	84.6275	92.7229	96.6196	106.0503 (65)

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

Metabolic gains (Table 5), Watts												
(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	3.0000	3.0000	3.0000	3.0000	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)

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Water heating gains (Table 5)												
	143.8167	141.4532	136.9001	126.9208	120.8083	114.4191	110.4948	113.7370	117.5382	124.6276	134.1939	142.5407 (72)
Total internal gains	515.4794	526.4147	505.3066	487.3056	463.2147	443.6614	427.1572	428.2571	440.9277	459.0389	486.5836	505.0944 (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	655.9874	772.3835	859.4667	955.6520	1014.7508	1003.0632	961.5471	898.7715	834.3460	735.6362	656.0875	624.5586 (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, n _{l,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	0.9260	0.8857	0.8275	0.7217	0.5853	0.4333	0.3199	0.3546	0.5393	0.7637	0.8881	0.9342 (86)
MIT	19.3023	19.6394	20.0410	20.4905	20.7877	20.9388	20.9821	20.9751	20.8769	20.4814	19.8337	19.2456 (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	0.9161	0.8714	0.8066	0.6904	0.5422	0.3792	0.2579	0.2899	0.4822	0.7291	0.8717	0.9253 (89)
MIT 2	18.1215	18.5393	19.0316	19.5717	19.9055	20.0664	20.1030	20.1000	20.0089	19.5767	18.7953	18.0567 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.5274 (91)
MIT	18.7443	19.1195	19.5640	20.0563	20.3708	20.5265	20.5667	20.5616	20.4667	20.0539	19.3430	18.6838 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7443	19.1195	19.5640	20.0563	20.3708	20.5265	20.5667	20.5616	20.4667	20.0539	19.3430	18.6838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8983	0.8537	0.7932	0.6887	0.5555	0.4048	0.2899	0.3229	0.5057	0.7270	0.8556	0.9081 (94)
Useful gains	589.2805	659.4217	681.7125	658.1807	563.6506	406.0872	278.7468	290.2159	421.9600	534.7923	561.3590	567.1627 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1063.6927	1044.3409	956.9540	807.0960	625.8142	423.0662	283.1614	296.4668	456.4230	682.3307	887.8364	1055.5295 (97)
Space heating kWh	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98a)
Space heating requirement - total per year (kWh/year)												1678.0540
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	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1678.0540
Space heating per m2										(98c) / (4) =		22.6764 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	352.9627	258.6657	204.7797	107.2190	46.2497	0.0000	0.0000	0.0000	0.0000	109.7686	235.0638	363.3449 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	382.4081	280.2445	221.8632	116.1636	50.1080	0.0000	0.0000	0.0000	0.0000	118.9259	254.6736	393.6565 (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)

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Water heating requirement	224.5362	198.5758	211.2029	186.5329	181.3278	163.9655	162.3526	168.5532	170.1052	188.9676	200.0144	222.2182 (64)
Efficiency of water heater (217)m	85.0697	84.6536	83.9906	82.8654	81.4782	79.8000	79.8000	79.8000	79.8000	82.8868	84.4228	79.8000 (216)
Fuel for water heating, kWh/month	263.9439	234.5745	251.4603	225.1033	222.5476	205.4706	203.4494	211.2195	213.1644	227.9828	236.9198	85.1553 (217)
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	7.0685	7.3041	7.0685	7.3041	7.0685 (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												1818.0434 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2756.7924 (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												4103.9208 (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	1818.0434	0.2100	381.7891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2756.7924	0.2100	578.9264 (264)
Space and water heating			960.7155 (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			902.9043 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.2000 (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	1818.0434	1.1300	2054.3890 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2756.7924	1.1300	3115.1754 (278)
Space and water heating			5169.5645 (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			4804.5745 (286)
Target Primary Energy Rate (TPER)			64.9300 (287)

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Property Reference	Flat 304 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 304 VL - Be Green		Prop Type Ref	Flat 103 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	83 B	DER	3.45	TER	15.27	
Environmental	98 A	% DER < TER				77.41
CO ₂ Emissions (t/year)	0.16	DFEE	36.78	TFEE	36.44	
Compliance Check	See BREL	% DFEE < TFEE				-0.94
% DPER < TPER	54.82	DPER	36.76	TPER	81.36	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

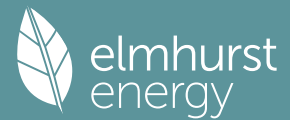
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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			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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)	
Average = Sum(39)m / 12 =	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)	
												41.2852	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

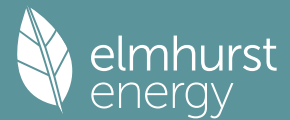
4. Water heating energy requirements (kWh/year)

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)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)	
Distribution loss (46)m = 0.15 x (45)m												1667.8640	
Water storage loss:	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)	
Store volume												172.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.6300 (48)	
Temperature factor from Table 2b												0.7800 (49)	
Enter (49) or (54) in (55)												1.2714 (55)	
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)	
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (62)	
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)	
12Total per year (kWh/year)												2405.8210 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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)	

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341 (72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast				13.1800	11.2829	0.4700	0.7000	0.7700	33.9052 (75)						
Southeast				1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)						
Southwest				0.9000	36.7938	0.4700	0.7000	0.7700	7.5500 (79)						
Solar gains				58.0652	110.1685	180.6511	273.9755	352.6409	370.2215	348.5556	286.7900	212.4837	129.8252	71.5997	48.3646 (83)
Total gains				481.3196	541.2475	595.6645	674.6437	734.8764	739.5602	705.2938	644.6827	580.1329	509.3804	472.5028	463.8166 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.8859	0.8432	0.7739	0.6425	0.4904	0.3434	0.2506	0.2846	0.4613	0.6974	0.8367	0.8946 (86)	
MIT	19.7452	20.0021	20.3339	20.6998	20.8978	20.9769	20.9940	20.9908	20.9385	20.6701	20.1840	19.7117 (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	0.8742	0.8281	0.7535	0.6147	0.4567	0.3061	0.2098	0.2408	0.4177	0.6657	0.8187	0.8836 (89)	
MIT 2	18.7832	19.0998	19.5037	19.9417	20.1626	20.2536	20.2684	20.2686	20.2149	19.9200	19.3381	18.7489 (90)	
Living area fraction	fLA = Living area / (4) =												0.5727 (91)
MIT	19.3341	19.6165	19.9792	20.3759	20.5837	20.6679	20.6839	20.6822	20.6293	20.3496	19.8226	19.3003 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.3341	19.6165	19.9792	20.3759	20.5837	20.6679	20.6839	20.6822	20.6293	20.3496	19.8226	19.3003 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8581	0.8143	0.7457	0.6193	0.4716	0.3265	0.2330	0.2655	0.4395	0.6697	0.8073	0.8677 (94)	
Ext temp.	413.0329	440.7147	444.2055	417.7789	346.5796	241.4600	164.3057	171.1837	254.9889	341.1318	381.4546	402.4339 (95)	
Heat loss rate W	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)	
Space heating kWh	636.0696	620.5559	566.4785	474.1892	365.8230	245.5890	165.2913	172.7102	266.1075	401.4803	527.4976	630.3454 (97)	
Space heating requirement - total per year (kWh/year)	165.9393	120.8533	90.9711	40.6154	14.3171	0.0000	0.0000	0.0000	0.0000	44.8993	105.1510	169.5661 (98a)	
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)	165.9393	120.8533	90.9711	40.6154	14.3171	0.0000	0.0000	0.0000	0.0000	44.8993	105.1510	169.5661 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	(98c) / (4) =												14.4675 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	165.9393	120.8533	90.9711	40.6154	14.3171	0.0000	0.0000	0.0000	0.0000	44.8993	105.1510	169.5661 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	165.9393	120.8533	90.9711	40.6154	14.3171	0.0000	0.0000	0.0000	0.0000	44.8993	105.1510	169.5661	

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Space heating requirement	165.9393	120.8533	90.9711	40.6154	14.3171	0.0000	0.0000	0.0000	0.0000	44.8993	105.1510	169.5661 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	15.1262	13.6624	15.1262	14.6383	15.1262	14.6383	15.1262	15.1262	14.6383	15.1262	14.6383	15.1262 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												752.3124 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												7.5231 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												178.0989 (330a)
Total electricity for the above, kWh/year												178.0989 (331)
Electricity for lighting (calculated in Appendix L)												136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3472.5691 (338)

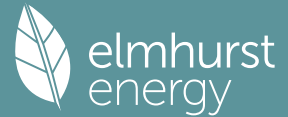
12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	902.3238	0.1564	33.6070 (367)
Electrical energy for heat distribution (space & water)	7.5231	0.0000	4.5612 (372)
Overall CO2 factor for heat network			0.0427 (386)
Total CO2 associated with community systems			134.8815 (373)
Space and water heating			134.8815 (376)
Pumps, fans and electric keep-hot	178.0989	0.1387	24.7045 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			179.2637 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4500 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	902.3238	1.5788	339.3615 (467)
Electrical energy for heat distribution (space & water)	7.5231	0.0000	48.4520 (472)
Overall CO2 factor for heat network			0.4537 (486)
Total CO2 associated with community systems			1432.7951 (473)
Space and water heating			1432.7951 (476)
Pumps, fans and electric keep-hot	178.0989	1.5128	269.4280 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			1911.3411 (483)
Dwelling Primary energy Rate (DPER)			36.7600 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

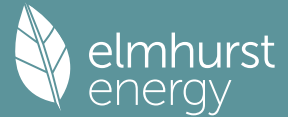
List of Thermal Bridges

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	0.0200	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
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)

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HLP (average)												1.0821
Days in month	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 content (annual)	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)												
Distribution loss (46)m = 0.15 x (45)m												1667.8640
25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478	(62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
												2012.0777 (64)
12Total per year (kWh/year)												2012 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647	(65)

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

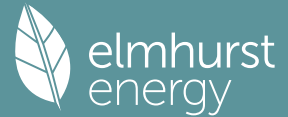
Metabolic gains (Table 5), Watts												
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
77.0119	85.2631	77.0119	79.5789	77.0119	79.5789	77.0119	77.0119	79.5789	77.0119	79.5789	77.0119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)												
129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains	411.1980	419.0366	402.9570	388.6162	370.1790	354.2867	341.6819	342.8363	352.5972	367.4989	388.8511	403.3956 (73)

6. Solar gains												

[Jan]												
			Area	Solar flux				FF		Access		Gains
			m2	Table 6a		g		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast			9.1100	11.2829		0.6300		0.7000		0.7700		31.4132 (75)
Southeast			1.3700	36.7938		0.6300		0.7000		0.7700		15.4052 (77)
Southwest			0.6200	36.7938		0.6300		0.7000		0.7700		6.9717 (79)

Solar gains	53.7901	102.0587	167.3563	253.8173	326.6983	342.9869	322.9142	265.6903	196.8478	120.2693	66.3283	44.8036 (83)
Total gains	464.9881	521.0952	570.3132	642.4335	696.8773	697.2735	664.5961	608.5266	549.4450	487.7682	455.1794	448.1992 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,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	0.9285	0.9020	0.8572	0.7620	0.6270	0.4715	0.3548	0.3990	0.6000	0.8037	0.8987	0.9344 (86)	
MIT	19.0176	19.2997	19.7235	20.2707	20.6748	20.8964	20.9661	20.9520	20.7879	20.2676	19.5725	18.9737 (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	0.9185	0.8888	0.8378	0.7309	0.5809	0.4098	0.2810	0.3216	0.5370	0.7703	0.8829	0.9252 (89)	
MIT 2	17.7127	18.0647	18.5894	19.2528	19.7127	19.9478	20.0077	20.0000	19.8484	19.2680	18.4184	17.6632 (90)	
Living area fraction									fLA = Living area / (4) =				0.5727 (91)
MIT	18.4600	18.7719	19.2389	19.8357	20.2637	20.4911	20.5565	20.5452	20.3865	19.8405	19.0793	18.4138 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.4600	18.7719	19.2389	19.8357	20.2637	20.4911	20.5565	20.5452	20.3865	19.8405	19.0793	18.4138 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8994	0.8691	0.8206	0.7247	0.5930	0.4399	0.3217	0.3635	0.5614	0.7636	0.8649	0.9066 (94)
Useful gains	418.1911	452.8887	468.0123	465.6019	413.2160	306.7602	213.8226	221.2138	308.4844	372.4680	393.6706	406.3159 (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	809.5493	791.1795	724.8441	615.3424	480.8578	327.5488	219.9879	230.0580	350.8661	518.8602	675.5112	805.0600 (97)
Space heating kWh	291.1705	227.3314	191.0828	107.8132	50.3255	0.0000	0.0000	0.0000	0.0000	108.9158	202.9252	296.6656 (98a)
Space heating requirement - total per year (kWh/year)												1476.2302
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	291.1705	227.3314	191.0828	107.8132	50.3255	0.0000	0.0000	0.0000	0.0000	108.9158	202.9252	296.6656 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1476.2302
Space heating per m2										(98c) / (4) =		28.3890 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	291.1705	227.3314	191.0828	107.8132	50.3255	0.0000	0.0000	0.0000	0.0000	108.9158	202.9252	296.6656 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	315.4610	246.2962	207.0237	116.8074	54.5239	0.0000	0.0000	0.0000	0.0000	118.0020	219.8540	321.4146 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	84.9335	84.6547	84.1224	83.1326	81.7774	79.8000	79.8000	79.8000	79.8000	83.1249	84.3781	79.8000 (216)
Fuel for water heating, kWh/month	232.0388	206.0563	220.9008	198.1912	196.4029	182.6008	181.2006	187.7579	189.0926	200.9742	208.7492	229.5648 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)	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)	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)

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Annual totals kWh/year		
Space heating fuel - main system 1	1599.3827	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2433.5302	(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	3605.4970	(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	1599.3827	0.2100	335.8704 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2433.5302	0.2100	511.0413 (264)
Space and water heating			846.9117 (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			794.1219 (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	1599.3827	1.1300	1807.3025 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2433.5302	1.1300	2749.8891 (278)
Space and water heating			4557.1916 (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			4230.6515 (286)
Target Primary Energy Rate (TPER)			81.3600 (287)

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Property Reference	Flat 305 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 305 VL - Be Green		Prop Type Ref	Flat 103 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	83 B	DER	3.61	TER	16.49	
Environmental	97 A	% DER < TER				78.11
CO ₂ Emissions (t/year)	0.17	DFEE	40.78	TFEE	40.48	
Compliance Check	See BREL	% DFEE < TFEE				-0.76
% DPER < TPER	56.47	DPER	38.44	TPER	88.32	
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	52.0000 (1b)	x 2.8300 (2b)	= 147.1600 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.1600 (5)

2. Ventilation rate

	m ³ 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)

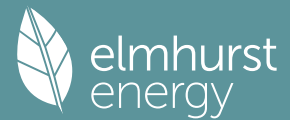
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												46.9155	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
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	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	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	32.5422	(42c)
Average daily hot water use (litres/day)													100.4145 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541	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)													
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	25.5894	(46)
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	(56)
If cylinder contains dedicated solar storage													
39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	233.2716	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	107.6650	95.9055	103.3223	93.9252	93.2179	86.3284	86.7416	88.7773	88.2233	95.6157	98.3445	106.8637	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
87.4535	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													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				11.2800	11.2829	0.4700	0.7000	0.7700	29.0175 (75)			
Southeast				5.8200	36.7938	0.4700	0.7000	0.7700	48.8233 (77)			
Northwest				1.8000	11.2829	0.4700	0.7000	0.7700	4.6305 (81)			
Solar gains	82.4713	151.6556	237.1887	343.6478	430.3325	447.1985	422.8332	355.1083	273.5739	175.6161	100.8169	69.2612 (83)
Total gains	505.7257	582.7346	652.2020	744.3160	812.5679	816.5372	779.5714	713.0009	641.2231	555.1714	501.7201	484.7132 (84)

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, nil,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	0.8904	0.8442	0.7729	0.6444	0.4958	0.3513	0.2572	0.2917	0.4679	0.7023	0.8426	0.8998	(86)
MIT	19.5108	19.8186	20.2035	20.6211	20.8608	20.9646	20.9899	20.9851	20.9139	20.5845	20.0084	19.4643	(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	0.8781	0.8281	0.7507	0.6140	0.4585	0.3089	0.2103	0.2414	0.4192	0.6679	0.8238	0.8884	(89)
MIT 2	18.4268	18.8055	19.2730	19.7702	20.0363	20.1513	20.1730	20.1720	20.1026	19.7436	19.0548	18.3759	(90)
Living area fraction	19.0995	19.4342	19.8505	20.2983	20.5480	20.6560	20.6800	20.6766	20.6061	20.2655	19.6466	19.0513	(92)
MIT	19.0995	19.4342	19.8505	20.2983	20.5480	20.6560	20.6800	20.6766	20.6061	20.2655	19.6466	19.0513	(93)
Temperature adjustment												0.0000	
adjusted MIT	19.0995	19.4342	19.8505	20.2983	20.5480	20.6560	20.6800	20.6766	20.6061	20.2655	19.6466	19.0513	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8606	0.8129	0.7422	0.6190	0.4758	0.3337	0.2390	0.2720	0.4450	0.6722	0.8108	0.8711	(94)
Ext temp.	435.2510	473.6826	484.0587	460.7671	386.5980	272.4809	186.3420	193.9289	285.3645	373.1746	406.8057	422.2102	(95)
Heat loss rate W	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)
Space heating kWh	709.4682	694.7003	636.2368	535.1569	414.1709	279.2075	188.1021	196.5645	301.7927	452.4381	590.8416	703.5681	(97)
Space heating requirement - total per year (kWh/year)	204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303	(98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303	(98c)
Space heating per m2	(98c) / (4) =												18.0893 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303	
Space heating requirement	204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303	

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204.0176	148.5238	113.2205	53.5607	20.5142	0.0000	0.0000	0.0000	0.0000	58.9720	132.5059	209.3303 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)											0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating											
Annual water heating requirement											
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00											
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	233.2716
Water heating fuel											
235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	15.1262	13.6624	15.1262	14.6383	15.1262	14.6383	15.1262	15.1262	14.6383	15.1262	15.1262 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)											
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)											
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)											
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)											
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year											
Space heating fuel - community heating											940.6451 (307)
Space heating fuel - secondary											0.0000 (309)
Water heating fuel - community heating											2405.8210 (310)
Efficiency of water heater											0.0000 (311)
Electricity used for heat distribution											9.4065 (313)
Space cooling fuel											0.0000 (321)
Electricity for pumps and fans:											
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)											
mechanical ventilation fans (SFP = 0.9920)											178.0989 (330a)
Total electricity for the above, kWh/year											178.0989 (331)
Electricity for lighting (calculated in Appendix L)											136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)											
PV generation											0.0000 (333)
Wind generation											0.0000 (334)
Hydro-electric generation (Appendix N)											0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)											0.0000 (335)
Appendix Q - special features											
Energy saved or generated											-0.0000 (336)
Energy used											0.0000 (337)
Total delivered energy for all uses											3660.9017 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	956.1332	0.1561	41.9594 (367)
Electrical energy for heat distribution (space & water)	9.4065	0.0000	4.8535 (372)
Overall CO2 factor for heat network			0.0429 (386)
Total CO2 associated with community systems			143.5263 (373)
Space and water heating			143.5263 (376)
Pumps, fans and electric keep-hot	178.0989	0.1387	24.7045 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			187.9084 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6100 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	956.1332	1.5780	424.0917 (467)
Electrical energy for heat distribution (space & water)	9.4065	0.0000	51.4176 (472)
Overall CO2 factor for heat network			0.4544 (486)
Total CO2 associated with community systems			1520.4908 (473)
Space and water heating			1520.4908 (476)
Pumps, fans and electric keep-hot	178.0989	1.5128	269.4280 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			1999.0367 (483)
Dwelling Primary energy Rate (DPER)			38.4400 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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)

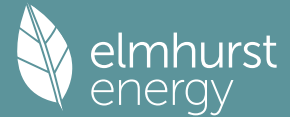
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3813	0.3738	0.3664	0.3290	0.3215	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							110.2388 (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	0.0200		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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												61.1211
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7491 (42)
Hot water usage for mixer showers	53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869	53.3405 (42a)
Hot water usage for baths	23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274	23.0714 (42b)
Hot water usage for other uses	32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589	32.5422 (42c)
Average daily hot water use (litres/day)												100.4145 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.2375	106.9057	104.0656	99.7460	96.2386	92.4676	91.0178	93.8456	96.8281	100.7870	105.1731	108.9541 (44)
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1667.8640
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2012.0777 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)

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

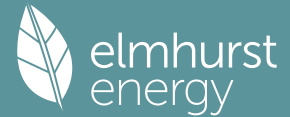
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472 (72)
Total internal gains	411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				6.6300	11.2829	0.6300	0.7000		0.7700		22.8617 (75)	
Southeast				3.4200	36.7938	0.6300	0.7000		0.7700		38.4568 (77)	
Northwest				1.0600	11.2829	0.6300	0.7000		0.7700		3.6551 (81)	
Solar gains	64.9735	119.4818	186.8753	270.7613	339.0677	352.3596	333.1604	279.7938	215.5454	138.3607	79.4273	54.5659 (83)
Total gains	476.1676	538.5140	589.8283	659.3734	709.2427	706.6422	674.8383	622.6261	568.1386	505.8557	468.2743	457.9576 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,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	0.9304	0.9038	0.8609	0.7729	0.6466	0.4949	0.3752	0.4179	0.6140	0.8093	0.9016	0.9363 (86)
MIT	18.8404	19.1415	19.5853	20.1576	20.6012	20.8633	20.9530	20.9359	20.7437	20.1749	19.4292	18.7913 (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	0.9202	0.8901	0.8409	0.7408	0.5978	0.4273	0.2924	0.3321	0.5469	0.7746	0.8853	0.9270 (89)
MIT 2	17.4435	17.8191	18.3689	19.0638	19.5710	19.8486	19.9255	19.9160	19.7393	19.1041	18.1920	17.3871 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.6206 (91)
MIT	18.3104	18.6398	19.1238	19.7426	20.2103	20.4783	20.5632	20.5489	20.3626	19.7686	18.9598	18.2585 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3104	18.6398	19.1238	19.7426	20.2103	20.4783	20.5632	20.5489	20.3626	19.7686	18.9598	18.2585 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9009	0.8701	0.8234	0.7342	0.6108	0.4622	0.3416	0.3820	0.5747	0.7683	0.8672	0.9082 (94)
Useful gains	428.9818	468.5763	485.6590	484.1388	433.2262	326.6215	230.4991	237.8602	326.4830	388.6390	406.0731	415.9232 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	868.9858	850.3167	779.5536	662.7174	519.1617	355.3662	239.5882	250.3962	379.9258	559.3166	726.3226	864.4883 (97)
Space heating kWh	327.3630	256.5295	218.6576	128.5765	63.9360	0.0000	0.0000	0.0000	0.0000	126.9841	230.5796	333.7325 (98a)
Space heating requirement - total per year (kWh/year)												1686.3589
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	327.3630	256.5295	218.6576	128.5765	63.9360	0.0000	0.0000	0.0000	0.0000	126.9841	230.5796	333.7325 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1686.3589
Space heating per m ²										(98c) / (4) =		32.4300 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	327.3630	256.5295	218.6576	128.5765	63.9360	0.0000	0.0000	0.0000	0.0000	126.9841	230.5796	333.7325 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	354.6728	277.9301	236.8988	139.3028	69.2698	0.0000	0.0000	0.0000	0.0000	137.5776	249.8154	361.5736 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	85.1895	84.9233	84.4256	83.5099	82.1713	79.8000	79.8000	79.8000	79.8000	83.4526	84.6647	79.8000 (216)
Fuel for water heating, kWh/month	231.3416	205.4046	220.1075	197.2959	195.4615	182.6008	181.2006	187.7579	189.0926	200.1849	208.0424	85.2525 (217)
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)	-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)	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)	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)	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)	-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)	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)	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)	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												1827.0410 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2427.3661 (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	3955.4960 (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	1827.0410	0.2100	383.6786 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2427.3661	0.2100	509.7469 (264)
Space and water heating			893.4255 (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			857.2543 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.4900 (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	1827.0410	1.1300	2064.5563 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2427.3661	1.1300	2742.9237 (278)
Space and water heating			4807.4800 (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			4592.8889 (286)
Target Primary Energy Rate (TPER)			88.3200 (287)

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Property Reference	Flat 401 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 401 VL - Be Green		Prop Type Ref	Flat 203 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	82 B	DER	3.78	TER	16.52	
Environmental	97 A	% DER < TER				77.12
CO ₂ Emissions (t/year)	0.17	DFEE	43.84	TFEE	39.52	
Compliance Check	See BREL	% DFEE < TFEE				-10.94
% DPER < TPER	54.70	DPER	40.13	TPER	88.57	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

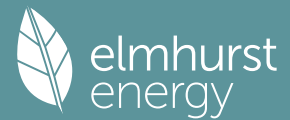
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												84.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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) = 4906.4201 (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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)	
Average = Sum(39)m / 12 =	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)	47.9961
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)	0.9599
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

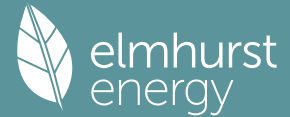
4. Water heating energy requirements (kWh/year)

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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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)													
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)	
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)	
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month													
	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (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													
	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (64)	
Total per year (kWh/year) = Sum(64)m =												2375.0127 (64)	
12Total per year (kWh/year)												2375 (64)	
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month													
	106.6024	94.9706	102.3400	93.0866	92.4222	85.6301	86.0656	88.0636	87.4899	94.7756	97.4242	105.8159 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	143.2828	141.3252	137.5538	129.2869	124.2234	118.9307	115.6795	118.3651	121.5138	127.3866	135.3113	142.2257 (72)
	413.1308	420.6579	405.0796	391.0918	373.2064	360.6649	348.4420	349.5997	359.0740	370.6677	391.4143	405.5774 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF				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	483.4541	558.2858	640.7782	762.5665	861.7916	877.6084	833.5589	742.4713	641.0221	535.5535	478.8945	463.6571 (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, nil,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	0.8950	0.8515	0.7761	0.6355	0.4769	0.3343	0.2461	0.2862	0.4731	0.7159	0.8513	0.9038 (86)	
MIT	19.3112	19.6354	20.0824	20.5733	20.8477	20.9603	20.9880	20.9813	20.8915	20.4926	19.8447	19.2620 (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	0.8829	0.8355	0.7535	0.6040	0.4388	0.2915	0.1986	0.2341	0.4218	0.6809	0.8327	0.8926 (89)	
MIT 2	18.1486	18.5484	19.0919	19.6736	19.9763	20.0992	20.1228	20.1207	20.0353	19.6007	18.8228	18.0939 (90)	
Living area fraction	18.8752	19.2278	19.7109	20.2359	20.5209	20.6374	20.6636	20.6586	20.5704	20.1581	19.4614	18.8240 (92)	
MIT	18.8752	19.2278	19.7109	20.2359	20.5209	20.6374	20.6636	20.6586	20.5704	20.1581	19.4614	18.8240 (93)	
Temperature adjustment												0.0000	
adjusted MIT	18.8752	19.2278	19.7109	20.2359	20.5209	20.6374	20.6636	20.6586	20.5704	20.1581	19.4614	18.8240 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8635	0.8178	0.7428	0.6085	0.4565	0.3166	0.2278	0.2659	0.4484	0.6826	0.8172	0.8734 (94)	
Ext temp.	417.4634	456.5904	475.9558	463.9855	393.3719	277.8774	189.9077	197.3920	287.4131	365.5506	391.3519	404.9427 (95)	
Heat loss rate W	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)	
Space heating kWh	713.5894	699.5715	643.2867	544.4578	422.4915	285.1616	191.9315	200.5774	307.3320	457.8016	595.3541	708.2074 (97)	
Space heating requirement - total per year (kWh/year)	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290 (98a)	
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating kWh	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290 (98c)	
Space heating per m2	(98c) / (4) =												20.5769 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290	
Space heating requirement	220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290	

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220.3178	163.2833	124.4942	57.9400	21.6650	0.0000	0.0000	0.0000	0.0000	68.6348	146.8816	225.6290	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating												
Annual water heating requirement												
232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203
Water heating fuel												
232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203	(310)
Cooling System Energy Efficiency Ratio												
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	14.2361	12.8584	14.2361	13.7768	14.2361	13.7768	14.2361	13.7768	14.2361	13.7768	14.2361	(331)
Lighting	16.5676	13.2912	11.9672	8.7677	6.7724	5.5331	6.1780	8.0304	10.4307	13.6857	15.4580	(332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year												
Space heating fuel - community heating												1028.8456 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2375.0127 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												10.2885 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												167.6182 (330a)
Total electricity for the above, kWh/year												167.6182 (331)
Electricity for lighting (calculated in Appendix L)												133.7101 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3705.1866 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	972.5309	0.1560	45.8631 (367)
Electrical energy for heat distribution (space & water)	10.2885	0.0000	4.9466 (372)
Overall CO2 factor for heat network			0.0430 (386)
Total CO2 associated with community systems			146.2768 (373)
Space and water heating			146.2768 (376)
Pumps, fans and electric keep-hot	167.6182	0.1387	23.2507 (378)
Energy for lighting	133.7101	0.1443	19.2985 (379)
Total CO2, kg/year			188.8260 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7800 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	972.5309	1.5776	463.7450 (467)
Electrical energy for heat distribution (space & water)	10.2885	0.0000	52.3361 (472)
Overall CO2 factor for heat network			0.4547 (486)
Total CO2 associated with community systems			1547.6518 (473)
Space and water heating			1547.6518 (476)
Pumps, fans and electric keep-hot	167.6182	1.5128	253.5729 (478)
Energy for lighting	133.7101	1.5338	205.0890 (479)
Total Primary energy kWh/year			2006.3137 (483)
Dwelling Primary energy Rate (DPER)			40.1300 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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)

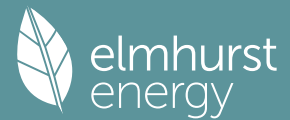
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3897	0.3821	0.3744	0.3362	0.3286	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							108.1284 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E7 Party floor between dwellings (in blocks of flats)				50.3200	0.0700		3.5224
E23 Balcony within or between dwellings, balcony support penetrates wall insulation				6.1900	0.0200		0.1238
E16 Corner (normal)				8.3100	0.0900		0.7479
E17 Corner (inverted - internal area greater than external area)				2.7700	-0.0900		-0.2493
E18 Party wall between dwellings				5.5400	0.0600		0.3324
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				10.6000	0.0000		0.0000
E1 Steel lintel with perforated steel base plate				10.5000	0.0500		0.5250
E3 Sill				9.6000	0.0500		0.4800
E4 Jamb				27.8000	0.0500		1.3900
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8722 (36)
Point Thermal bridges							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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
												56.6503
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers												
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths												
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses												
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415 (44)
Energy content (annual)	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)
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:												172.0000 (47)
Store volume												1.5107 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8158 (55)
Enter (49) or (54) in (55)												
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	218.3618	193.2737	205.5426	181.0109	175.7146	158.5854	156.5969	162.6061	164.1790	182.7926	194.0564	215.9965 (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	194.3349	172.0242	183.2913	162.5860	158.5432	143.8918	142.8239	147.9599	148.9763	164.8704	173.7527	192.4146 (64)
12Total per year (kWh/year)												1985.4693 (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	95.3034	84.7650	91.0410	82.1520	81.1232	74.6955	74.7665	76.7646	76.5554	83.4766	86.4896	94.5169 (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)
(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	
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	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)	128.0959	126.1384	122.3669	114.1000	109.0365	103.7438	100.4926	103.1782	106.3269	112.1998	120.1245	127.0389	(72)
Total internal gains	401.0920	408.6349	393.0408	379.0579	361.1676	345.6311	333.4032	334.5609	344.0401	358.6289	379.3804	393.5386	(73)

6. Solar gains

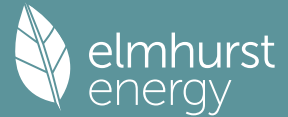
[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				

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	444.8848	494.3401	539.8165	610.3835	665.4194	667.5417	635.4950	579.2104	519.6162	461.3081	433.8573	429.7069 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,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	0.9310	0.9076	0.8662	0.7756	0.6435	0.4884	0.3703	0.4171	0.6210	0.8165	0.9037	0.9363 (86)
MIT	18.8748	19.1498	19.5871	20.1708	20.6181	20.8729	20.9566	20.9390	20.7445	20.1731	19.4487	18.8331 (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	0.9212	0.8947	0.8473	0.7445	0.5961	0.4233	0.2910	0.3342	0.5558	0.7836	0.8881	0.9272 (89)
MIT 2	17.5093	17.8532	18.3963	19.1065	19.6183	19.8891	19.9614	19.9514	19.7713	19.1292	18.2401	17.4623 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.6250 (91)
MIT	18.3628	18.6636	19.1405	19.7716	20.2431	20.5039	20.5834	20.5686	20.3796	19.7817	18.9955	18.3190 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3628	18.6636	19.1405	19.7716	20.2431	20.5039	20.5834	20.5686	20.3796	19.7817	18.9955	18.3190 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9021	0.8750	0.8298	0.7378	0.6091	0.4573	0.3384	0.3827	0.5825	0.7765	0.8702	0.9087 (94)
Useful gains	401.3477	432.5633	447.9470	450.3693	405.2831	305.2990	215.0825	221.6794	302.6867	358.2176	377.5326	390.4814 (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	809.1471	790.0769	723.9419	615.8885	482.9851	330.5878	223.0480	233.0029	352.9271	519.0834	675.3035	804.9999 (97)
Space heating kWh	303.4027	240.2492	205.3402	119.1738	57.8104	0.0000	0.0000	0.0000	0.0000	119.6841	214.3950	308.4018 (98a)
Space heating requirement - total per year (kWh/year)												1568.4572
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	303.4027	240.2492	205.3402	119.1738	57.8104	0.0000	0.0000	0.0000	0.0000	119.6841	214.3950	308.4018 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1568.4572
Space heating per m ²										(98c) / (4) =		31.3691 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	303.4027	240.2492	205.3402	119.1738	57.8104	0.0000	0.0000	0.0000	0.0000	119.6841	214.3950	308.4018 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	328.7137	260.2916	222.4704	129.1157	62.6331	0.0000	0.0000	0.0000	0.0000	129.6686	232.2806	334.1298 (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	194.3349	172.0242	183.2913	162.5860	158.5432	143.8918	142.8239	147.9599	148.9763	164.8704	173.7527	192.4146 (64)
Efficiency of water heater	85.0547	84.8090	84.3151	83.3741	82.0213	79.8000	79.8000	79.8000	79.8000	83.3532	84.5323	79.8000 (216)
Fuel for water heating, kWh/month	228.4823	202.8373	217.3884	195.0079	193.2953	180.3155	178.9773	185.4134	186.6872	197.7973	205.5460	85.1120 (217)
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												1699.3036 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2397.8201 (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	3813.6283 (238)

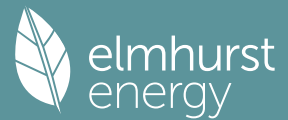
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1699.3036	0.2100	356.8538 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2397.8201	0.2100	503.5422 (264)
Space and water heating			860.3960 (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			826.1606 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.5200 (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	1699.3036	1.1300	1920.2130 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2397.8201	1.1300	2709.5367 (278)
Space and water heating			4629.7498 (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			4428.6741 (286)
Target Primary Energy Rate (TPER)			88.5700 (287)

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Property Reference	Flat 401 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 401 WCS - Green	Prop Type Ref		Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	85 B	DER	2.74	TER	12.59	
Environmental	97 A	% DER < TER				78.24
CO ₂ Emissions (t/year)	0.34	DFEE	43.75	TFEE	46.87	
Compliance Check	See BREL	% DFEE < TFEE				6.65
% DPER < TPER	56.72	DPER	28.85	TPER	66.66	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

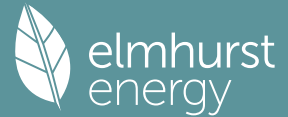
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.2297	0.2268	0.2239	0.2094	0.2065	0.1919	0.1919	0.1890	0.1977	0.2065	0.2123	0.2181 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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Solid Door				2.0000	0.8000	1.6000							(26)
Heatloss Floor 1				16.0400	0.1000	1.6040							(28b)
External Wall 1	188.1100	37.5200		150.5900	0.1500	22.5885	14.0000	2108.2600					(29a)
External Roof 1	77.0000			77.0000	0.1000	7.7000	9.0000	693.0000					(30)
Total net area of external elements Aum(A, m2)				281.1500									(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		66.0012							(33)
Party Wall 1				10.0400	0.0000	0.0000	20.0000	200.8000					(32)
Party Floor 1				61.0000			40.0000	2440.0000					(32d)
Internal Wall 1				229.6900			9.0000	2067.2100					(32c)
Internal Floor 1				61.0000			30.0000	1830.0000					(32d)
Internal Ceiling 1				61.0000			30.0000	1830.0000					(32e)
Heat capacity Cm = Sum(A x k)													
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													(28)...(30) + (32) + (32a)...(32e) = 11650.4700 (34)
List of Thermal Bridges													84.4237 (35)
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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	29.7945	29.4176	29.0406	27.1559	26.7790	24.8943	24.8943	24.5173	25.6482	26.7790	27.5329	28.2867	
Average = Sum(39)m / 12 =	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)
													129.6187
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
													0.9393
													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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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)													
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:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	298.7684	264.3530	280.9421	246.9912	239.4712	215.8117	212.8925	221.2484	223.5920	249.3156	265.1315	295.4803	(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													
	298.7684	264.3530	280.9421	246.9912	239.4712	215.8117	212.8925	221.2484	223.5920	249.3156	265.1315	295.4803	(64)
Total per year (kWh/year) = Sum(64)m =													3013.9978 (64)
12Total per year (kWh/year)													3014 (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													
	128.6414	114.3627	122.7142	110.4803	108.9251	100.1131	100.0877	102.8660	102.7001	112.1984	116.5120	127.5481	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	145.6589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	154.9100	171.5075	154.9100	160.0737	154.9100	160.0737	154.9100	154.9100	160.0737	154.9100	160.0737	154.9100	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	307.1264	310.3134	302.2822	285.1848	263.6024	243.3180	229.7668	226.5798	234.6110	251.7084	273.2907	293.5752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	37.5659	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	-116.5271	(71)
Water heating gains (Table 5)	172.9052	170.1826	164.9384	153.4449	146.4047	139.0460	134.5265	138.2608	142.6390	150.8043	161.8222	171.4356	(72)
Total internal gains	701.6392	718.7012	688.8283	665.4011	631.6149	609.1354	585.9009	586.4482	604.0213	624.1203	661.8843	686.6185	(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	906.5498	1081.4114	1221.4183	1386.1739	1494.4980	1490.2165	1425.1873	1315.9778	1201.1914	1034.7835	909.8097	860.3682 (84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)													
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	0.9411	0.9094	0.8619	0.7705	0.6445	0.4925	0.3735	0.4151	0.6101	0.8146	0.9129	0.9476	(86)
MIT	18.6130	18.9902	19.4921	20.1109	20.5748	20.8542	20.9491	20.9316	20.7296	20.1087	19.2687	18.5566	(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	0.9341	0.8991	0.8462	0.7449	0.6057	0.4387	0.3073	0.3468	0.5568	0.7877	0.9013	0.9413	(89)
MIT 2	17.3039	17.7782	18.4051	19.1678	19.7128	20.0254	20.1149	20.1038	19.9010	19.1835	18.1426	17.2383	(90)
Living area fraction									f _{LA} = Living area / (4) =			0.1300	(91)
MIT	17.4741	17.9357	18.5464	19.2904	19.8249	20.1332	20.2234	20.2114	20.0087	19.3037	18.2890	17.4097	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4741	17.9357	18.5464	19.2904	19.8249	20.1332	20.2234	20.2114	20.0087	19.3037	18.2890	17.4097	(93)

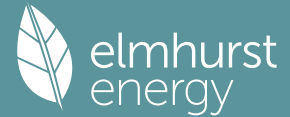
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9052	0.8659	0.8118	0.7167	0.5907	0.4377	0.3133	0.3520	0.5479	0.7572	0.8690	0.9141	(94)
Useful gains	820.6446	936.3968	991.5736	993.5132	882.7711	652.3323	446.5519	463.1654	658.0967	783.5872	790.6462	786.4868	(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	1743.6121	1720.3849	1585.2754	1347.7720	1050.8375	705.2111	461.8033	484.3296	757.5266	1125.7061	1455.5700	1728.4051	(97)
Space heating kWh	686.6878	526.8400	441.7141	255.0664	125.0414	0.0000	0.0000	0.0000	0.0000	254.5364	478.7451	700.7872	(98a)
Space heating requirement - total per year (kWh/year)												3469.4184	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	686.6878	526.8400	441.7141	255.0664	125.0414	0.0000	0.0000	0.0000	0.0000	254.5364	478.7451	700.7872	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3469.4184	
Space heating per m2										(98c) / (4) =		25.1407	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump-Space and Water	1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000 (305)

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Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
686.6878 526.8400 441.7141 255.0664 125.0414 0.0000 0.0000 0.0000 0.0000 254.5364 478.7451 700.7872	(98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00		
307a 686.6878 526.8400 441.7141 255.0664 125.0414 0.0000 0.0000 0.0000 0.0000 254.5364 478.7451 700.7872		
Space heating requirement		
686.6878 526.8400 441.7141 255.0664 125.0414 0.0000 0.0000 0.0000 0.0000 254.5364 478.7451 700.7872	(307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(309)	
Water heating		
Annual water heating requirement		
298.7684 264.3530 280.9421 246.9912 239.4712 215.8117 212.8925 221.2484 223.5920 249.3156 265.1315 295.4803	(64)	
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00		
310a 298.7684 264.3530 280.9421 246.9912 239.4712 215.8117 212.8925 221.2484 223.5920 249.3156 265.1315 295.4803		
Water heating fuel		
298.7684 264.3530 280.9421 246.9912 239.4712 215.8117 212.8925 221.2484 223.5920 249.3156 265.1315 295.4803	(310)	
Cooling System Energy Efficiency Ratio		
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(314)	
Pumps and Fa 35.3488 31.9279 35.3488 34.2085 35.3488 34.2085 35.3488 34.2085 35.3488 34.2085 35.3488 34.2085	(315)	
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	(332)	
Electricity generated by PVs (Appendix M) (negative quantity)		
(333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(333a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(334a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(335a)	
Electricity generated by PVs (Appendix M) (negative quantity)		
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(333b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(334b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(335b)	
Annual totals kWh/year		
Space heating fuel - community heating	3469.4184	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	3013.9978	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	34.6942	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)		
mechanical ventilation fans (SFP = 0.8680)	416.2030	(330a)
Total electricity for the above, kWh/year	416.2030	(331)
Electricity for lighting (calculated in Appendix L)	248.7889	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	7148.4081	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1852.4046	0.1550	153.6921 (367)
Electrical energy for heat distribution (space & water)	34.6942	0.0000	9.6252 (372)
Overall CO2 factor for heat network			0.0439 (386)
Total CO2 associated with community systems			284.6321 (373)
Space and water heating			284.6321 (376)
Pumps, fans and electric keep-hot	416.2030	0.1387	57.7325 (378)
Energy for lighting	248.7889	0.1443	35.9079 (379)
Total CO2, kg/year			378.2725 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.7400 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1852.4046	1.5740	1560.2560 (467)
Electrical energy for heat distribution (space & water)	34.6942	0.0000	100.4491 (472)
Overall CO2 factor for heat network			0.4582 (486)
Total CO2 associated with community systems			2970.4241 (473)
Space and water heating			2970.4241 (476)
Pumps, fans and electric keep-hot	416.2030	1.5128	629.6320 (478)
Energy for lighting	248.7889	1.5338	381.6007 (479)
Total Primary energy kWh/year			3981.6568 (483)

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Dwelling Primary energy Rate (DPER)

28.8500 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

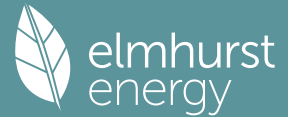
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

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

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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 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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	72.6853	72.3811	72.0828	70.6820	70.4200	69.1999	69.1999	68.9740	69.6699	70.4200	70.9501	71.5044 (38)
Heat transfer coeff	186.0436	185.7393	185.4411	184.0403	183.7782	182.5582	182.5582	182.3322	183.0281	183.7782	184.3084	184.8627 (39)
Average = Sum(39)m / 12 =												184.0390
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage												
	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	284.6446	251.5961	266.8183	233.3230	225.3475	202.1435	198.7687	207.1246	209.9238	235.1918	251.4633	281.3565 (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	251.2427	222.0551	235.8848	207.7088	201.4759	181.7165	179.6216	186.7636	188.7892	210.2764	223.2372	248.5731 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2537.3449 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	117.3424	104.1572	111.4152	99.5458	97.6261	89.1786	88.7887	91.5670	91.7655	100.8993	105.5774	116.2491 (65)

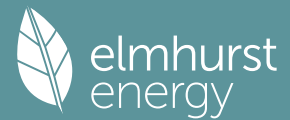
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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)												
	157.7183	154.9958	149.7516	138.2580	131.2179	123.8592	119.3396	123.0739	127.4521	135.6174	146.6353	156.2488 (72)
Total internal gains	689.4524	706.5144	676.6415	653.2142	619.4280	593.9485	570.7141	571.2614	588.8344	611.9334	649.6974	674.4316 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		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	940.7641	1151.3592	1329.8365	1537.2085	1677.7160	1674.5563	1600.0620	1465.9961	1321.2345	1115.5906	953.7645	887.5262 (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, nil,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	0.9459	0.9178	0.8765	0.7998	0.6913	0.5567	0.4394	0.4851	0.6698	0.8423	0.9231	0.9518 (86)
MIT	17.6398	18.0670	18.6876	19.4803	20.1624	20.6388	20.8469	20.8047	20.4227	19.5187	18.4401	17.5627 (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	0.9383	0.9065	0.8590	0.7705	0.6438	0.4833	0.3404	0.3853	0.6029	0.8125	0.9105	0.9449 (89)
MIT 2	15.9218	16.4576	17.2325	18.2072	19.0133	19.5406	19.7373	19.7076	19.3305	18.2796	16.9395	15.8272 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.1452	16.6668	17.4216	18.3727	19.1627	19.6834	19.8815	19.8502	19.4725	18.4407	17.1346	16.0528 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.1452	16.6668	17.4216	18.3727	19.1627	19.6834	19.8815	19.8502	19.4725	18.4407	17.1346	16.0528 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9022	0.8636	0.8121	0.7267	0.6137	0.4737	0.3457	0.3877	0.5800	0.7672	0.8689	0.9110 (94)
Useful gains	848.7450	994.3356	1080.0175	1117.0592	1029.6556	793.2817	553.1102	568.3413	766.3391	855.9318	828.7280	808.5208 (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	2203.7184	2185.5571	2025.3180	1743.3576	1371.4740	928.0123	599.0699	629.0845	983.3201	1440.9443	1849.4645	2191.1467 (97)
Space heating kWh	1008.1002	800.5008	703.3036	450.9349	254.3129	0.0000	0.0000	0.0000	0.0000	435.2493	734.9303	1028.6737 (98a)
Space heating requirement - total per year (kWh/year)												5416.0056
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	1008.1002	800.5008	703.3036	450.9349	254.3129	0.0000	0.0000	0.0000	0.0000	435.2493	734.9303	1028.6737 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5416.0056
Space heating per m2	(98c) / (4) =											39.2464 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1008.1002	800.5008	703.3036	450.9349	254.3129	0.0000	0.0000	0.0000	0.0000	435.2493	734.9303	1028.6737 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1092.1996	867.2815	761.9757	488.5535	275.5286	0.0000	0.0000	0.0000	0.0000	471.5594	796.2408	1114.4894 (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	251.2427	222.0551	235.8848	207.7088	201.4759	181.7165	179.6216	186.7636	188.7892	210.2764	223.2372	248.5731 (64)
Efficiency of water heater (217)m	86.8459	86.6772	86.3539	85.7501	84.5832	79.8000	79.8000	79.8000	79.8000	85.6533	86.5264	79.8000 (216)
Fuel for water heating, kWh/month	289.2970	256.1864	273.1604	242.2256	238.1985	227.7149	225.0897	234.0396	236.5779	245.4973	257.9990	286.0688 (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)

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

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	5867.8284	1.1300	6630.6461	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3012.0552	1.1300	3403.6223	(278)
Space and water heating			10034.2685	(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			9199.4649	(286)
Target Primary Energy Rate (TPER)			66.6600	(287)

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Property Reference	Flat 402 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 402 VL - Be Green	Prop Type Ref		Flat 402 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	82 B	DER	3.69	TER	17.19	
Environmental	97 A	% DER < TER				78.53
CO ₂ Emissions (t/year)	0.18	DFEE	40.96	TFEE	44.98	
Compliance Check	See BREL	% DFEE < TFEE				8.93
% DPER < TPER	57.27	DPER	39.19	TPER	91.71	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	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)

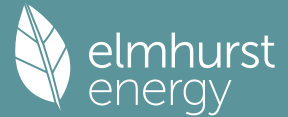
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

elmhurst
energy

[illegible]

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(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	13.1800	11.2829	0.4700	0.7000	0.7700	33.9052 (75)
Southeast	1.9800	36.7938	0.4700	0.7000	0.7700	16.6100 (77)
Southwest	0.9000	36.7938	0.4700	0.7000	0.7700	7.5500 (79)

Solar gains	58.0652	110.1685	180.6511	273.9755	352.6409	370.2215	348.5556	286.7900	212.4837	129.8252	71.5997	48.3646	(83)
Total gains	481.3196	541.2475	595.6645	674.6437	734.8764	739.5602	705.2938	644.6827	580.1329	509.3804	472.5028	463.8166	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n1,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	0.8652	0.8270	0.7674	0.6571	0.5225	0.3823	0.2852	0.3218	0.4966	0.7042	0.8222	0.8737	(86)
MIT	18.9486	19.2664	19.7232	20.2859	20.6795	20.8945	20.9628	20.9491	20.7913	20.2769	19.5496	18.8993	(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	0.8528	0.8117	0.7474	0.6293	0.4863	0.3379	0.2337	0.2674	0.4484	0.6730	0.8042	0.8620	(89)
MIT 2	17.7399	18.1337	18.6963	19.3778	19.8315	20.0697	20.1341	20.1256	19.9683	19.3858	18.4998	17.6838	(90)
Living area fraction	18.4321	18.7824	19.2844	19.8979	20.3172	20.5420	20.6087	20.5972	fLA = Living area / (4) =	20.4396	19.8961	19.1010	0.5727 (91)
MIT	18.4321	18.7824	19.2844	19.8979	20.3172	20.5420	20.6087	20.5972	20.4396	19.8961	19.1010	18.3799	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4321	18.7824	19.2844	19.8979	20.3172	20.5420	20.6087	20.5972	20.4396	19.8961	19.1010	18.3799	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8238	0.7843	0.7254	0.6208	0.4936	0.3584	0.2615	0.2960	0.4651	0.6630	0.7790	0.8332	(94)
Useful gains	396.5062	424.4972	432.0809	418.8053	362.7610	265.0562	184.4638	190.8407	269.8426	337.7057	368.0767	386.4463	(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	691.6083	677.6928	622.5311	528.8164	413.2911	281.3590	189.8140	198.2268	301.7337	445.8561	578.5185	687.0175	(97)
Space heating kWh	219.5560	170.1474	141.6949	79.2080	37.5944	0.0000	0.0000	0.0000	0.0000	80.4639	151.5181	223.6250	(98a)
Space heating requirement - total per year (kWh/year)												1103.8077	
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	219.5560	170.1474	141.6949	79.2080	37.5944	0.0000	0.0000	0.0000	0.0000	80.4639	151.5181	223.6250	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1103.8077	
Space heating per m2										(98c) / (4) =		21.2271	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	219.5560	170.1474	141.6949	79.2080	37.5944	0.0000	0.0000	0.0000	0.0000	80.4639	151.5181	223.6250	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													

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307a	219.5560	170.1474	141.6949	79.2080	37.5944	0.0000	0.0000	0.0000	0.0000	80.4639	151.5181	223.6250
Space heating requirement	219.5560	170.1474	141.6949	79.2080	37.5944	0.0000	0.0000	0.0000	0.0000	80.4639	151.5181	223.6250 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.0951	11.8279	13.0951	12.6727	13.0951	12.6727	13.0951	13.0951	12.6727	13.0951	12.6727	13.0951 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1103.8077 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												11.0381 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												154.1846 (330a)
Total electricity for the above, kWh/year												154.1846 (331)
Electricity for lighting (calculated in Appendix L)												136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3800.1501 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1002.7511	0.1551	48.9294 (367)
Electrical energy for heat distribution (space & water)	11.0381	0.0000	5.0975 (372)
Overall CO2 factor for heat network			0.0430 (386)
Total CO2 associated with community systems			150.7403 (373)
Space and water heating			150.7403 (376)
Pumps, fans and electric keep-hot	154.1846	0.1387	21.3873 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			191.8052 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6900 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1002.7511	1.5744	496.5199 (467)
Electrical energy for heat distribution (space & water)	11.0381	0.0000	53.9526 (472)
Overall CO2 factor for heat network			0.4546 (486)
Total CO2 associated with community systems			1595.4540 (473)
Space and water heating			1595.4540 (476)
Pumps, fans and electric keep-hot	154.1846	1.5128	233.2504 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			2037.8224 (483)
Dwelling Primary energy Rate (DPER)			39.1900 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

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

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	Jan 1.2932	Feb 1.2907	Mar 1.2882	Apr 1.2765	May 1.2743	Jun 1.2641	Jul 1.2641	Aug 1.2622	Sep 1.2681	Oct 1.2743	Nov 1.2787	Dec 1.2834 (40)
HLP 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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m	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)
	Total = Sum(45)m =											1667.8640
Water storage loss:	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)
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)
WWHRS	-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2012.0777 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)

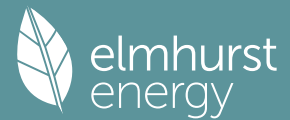
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	77.0119	85.2631	77.0119	79.5789	77.0119	79.5789	77.0119	77.0119	79.5789	77.0119	79.5789	77.0119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)													
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472	(72)
Total internal gains													
	411.1980	419.0366	402.9570	388.6162	370.1790	354.2867	341.6819	342.8363	352.5972	367.4989	388.8511	403.3956	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				9.1100	11.2829	0.6300	0.7000	0.7700	31.4132 (75)			
Southeast				1.3700	36.7938	0.6300	0.7000	0.7700	15.4052 (77)			
Southwest				0.6200	36.7938	0.6300	0.7000	0.7700	6.9717 (79)			
Solar gains	53.7901	102.0587	167.3563	253.8173	326.6983	342.9869	322.9142	265.6903	196.8478	120.2693	66.3283	44.8036 (83)
Total gains	464.9881	521.0952	570.3132	642.4335	696.8773	697.2735	664.5961	608.5266	549.4450	487.7682	455.1794	448.1992 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,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	0.8967	0.8698	0.8276	0.7450	0.6314	0.4968	0.3877	0.4300	0.6088	0.7807	0.8667	0.9030 (86)
MIT	17.8827	18.2278	18.7913	19.5576	20.2159	20.6681	20.8589	20.8202	20.4628	19.6285	18.6479	17.8247 (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	0.8846	0.8548	0.8072	0.7142	0.5853	0.4303	0.3016	0.3422	0.5450	0.7471	0.8490	0.8916 (89)
MIT 2	16.2822	16.7096	17.4060	18.3383	19.1079	19.6055	19.7867	19.7592	19.4069	18.4484	17.2451	16.2128 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.1988	17.5791	18.1993	19.0366	19.7425	20.2140	20.4007	20.3668	20.0116	19.1243	18.0485	17.1359 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1988	17.5791	18.1993	19.0366	19.7425	20.2140	20.4007	20.3668	20.0116	19.1243	18.0485	17.1359 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8478	0.8172	0.7716	0.6888	0.5801	0.4516	0.3434	0.3824	0.5538	0.7215	0.8131	0.8556 (94)
Useful gains	394.2358	425.8300	440.0347	442.5087	404.2643	314.8812	228.2316	232.7120	304.3060	351.9296	370.1198	383.4632 (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	867.4040	850.9542	783.6876	672.8445	532.9266	369.0375	249.8399	260.3697	389.8047	564.8522	728.0081	863.2755 (97)
Space heating kWh	352.0371	285.6835	255.6777	165.8418	95.7247	0.0000	0.0000	0.0000	0.0000	158.4144	257.6796	356.9804 (98a)
Space heating requirement - total per year (kWh/year)												1928.0392
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	352.0371	285.6835	255.6777	165.8418	95.7247	0.0000	0.0000	0.0000	0.0000	158.4144	257.6796	356.9804 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1928.0392
Space heating per m2												(98c) / (4) = 37.0777 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	352.0371	285.6835	255.6777	165.8418	95.7247	0.0000	0.0000	0.0000	0.0000	158.4144	257.6796	356.9804 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	381.4053	309.5162	277.0073	179.6769	103.7104	0.0000	0.0000	0.0000	0.0000	171.6299	279.1762	386.7610 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	85.3454	85.1589	84.7758	84.0745	82.9391	79.8000	79.8000	79.8000	79.8000	83.9408	84.9118	79.8000 (216)
Fuel for water heating, kWh/month	230.9189	204.8365	219.1984	195.9710	193.6521	182.6008	181.2006	187.7579	189.0926	199.0208	207.4372	228.4906 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)												

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(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)	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												2088.8832	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2420.1775	(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												4081.6448	(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	2088.8832	0.2100	438.6655 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2420.1775	0.2100	508.2373 (264)
Space and water heating			946.9028 (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			894.1129 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.1900 (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	2088.8832	1.1300	2360.4381 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2420.1775	1.1300	2734.8006 (278)
Space and water heating			5095.2386 (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			4768.6986 (286)
Target Primary Energy Rate (TPER)			91.7100 (287)

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Property Reference	Flat 402 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 402 WCS - Green		Prop Type Ref	Flat 402 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	82 B	DER	3.99	TER	18.11	
Environmental	97 A	% DER < TER				77.97
CO ₂ Emissions (t/year)	0.19	DFEE	49.46	TFEE	47.56	
Compliance Check	See BREL	% DFEE < TFEE				-3.99
% DPER < TPER	56.53	DPER	42.18	TPER	97.04	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

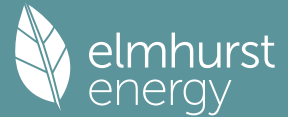
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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													
E18 Party wall between dwellings													
E16 Corner (normal)													
E17 Corner (inverted - internal area greater than external area)													
E7 Party floor between dwellings (in blocks of flats)													
E23 Balcony within or between dwellings, balcony support penetrates wall insulation													
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)													
E15 Flat roof with parapet													
E1 Steel lintel with perforated steel base plate													
E3 Sill													
E4 Jamb													
E24 Eaves (insulation at ceiling level - inverted)													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													
Point Thermal bridges													
Total fabric heat loss													

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 9.7392	Feb 9.6135	Mar 9.4878	Apr 8.8595	May 8.7338	Jun 8.1054	Jul 8.1054	Aug 7.9797	Sep 8.3567	Oct 8.7338	Nov 8.9851	Dec 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
HLP	Jan 1.2013	Feb 1.1989	Mar 1.1965	Apr 1.1844	May 1.1820	Jun 1.1699	Jul 1.1699	Aug 1.1675	Sep 1.1747	Oct 1.1820	Nov 1.1868	Dec 1.1916 (40)
HLP (average)												1.1838
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

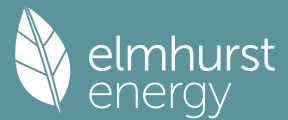
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7491 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use													
Energy conte													
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													
Enter (49) or (54) in (55)													
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss													
Combi loss													
Total heat required for water heating calculated for each month													
WVHRS													
PV diverter													
Solar input													
FGHRS													
Output from w/h													
12Total per year (kWh/year)													
Electric shower(s)													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month													

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

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(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

Southeast				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	556.9931	660.7311	734.1358	804.2936	841.8297	828.9086	798.4397	757.3344	715.9572	634.6916	561.4273	529.6870 (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, n _{l,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	0.8666	0.8177	0.7576	0.6644	0.5509	0.4201	0.3157	0.3432	0.4991	0.6939	0.8205	0.8773 (86)	
MIT	18.5373	18.9621	19.4770	20.0676	20.5227	20.8171	20.9306	20.9140	20.7152	20.1198	19.2452	18.4584 (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	0.8521	0.7991	0.7331	0.6312	0.5063	0.3618	0.2460	0.2721	0.4400	0.6558	0.7990	0.8638 (89)	
MIT 2	17.0975	17.6187	18.2477	18.9583	19.4809	19.8006	19.9040	19.8937	19.7027	19.0407	17.9864	17.0042 (90)	
Living area fraction	18.0317	18.4904	19.0453	19.6781	20.1569	20.4601	20.5701	20.5557	f _{LA} = Living area / (4) =	19.7409	18.8031	0.6488 (91)	
MIT	18.0317	18.4904	19.0453	19.6781	20.1569	20.4601	20.5701	20.5557	20.3597	19.7409	18.8031	17.9478 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.0317	18.4904	19.0453	19.6781	20.1569	20.4601	20.5701	20.5557	20.3597	19.7409	18.8031	17.9478 (93)	

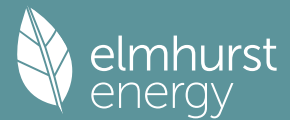
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8210	0.7702	0.7108	0.6227	0.5160	0.3910	0.2879	0.3140	0.4642	0.6483	0.7725	0.8330 (94)	
Useful gains	457.3111	508.9271	521.8472	500.8125	434.3714	324.0629	229.8931	237.7902	332.3626	411.4761	433.7031	441.2053 (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	857.7844	847.2451	780.5190	663.7946	519.7750	356.4912	241.5151	252.2854	382.3714	561.8178	722.2394	851.8753 (97)	
Space heating kWh	297.9521	227.3497	192.4518	117.3471	63.5403	0.0000	0.0000	0.0000	0.0000	111.8542	207.7462	305.5385 (98a)	
Space heating requirement - total per year (kWh/year)												1523.7800	
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	297.9521	227.3497	192.4518	117.3471	63.5403	0.0000	0.0000	0.0000	0.0000	111.8542	207.7462	305.5385 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1523.7800	
Space heating per m ²										(98c) / (4) =		29.3035 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	297.9521	227.3497	192.4518	117.3471	63.5403	0.0000	0.0000	0.0000	0.0000	111.8542	207.7462	305.5385 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													

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307a	297.9521	227.3497	192.4518	117.3471	63.5403	0.0000	0.0000	0.0000	0.0000	111.8542	207.7462	305.5385
Space heating requirement	297.9521	227.3497	192.4518	117.3471	63.5403	0.0000	0.0000	0.0000	0.0000	111.8542	207.7462	305.5385 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	11.7856	10.6451	11.7856	11.4054	11.7856	11.4054	11.7856	11.7856	11.4054	11.7856	11.4054	11.7856 (331)
Lighting	15.5992	12.5143	11.2677	8.2552	6.3766	5.2097	5.8169	7.5610	9.8210	12.8857	14.5544	16.0328 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1523.7800 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												15.2378 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)												138.7661 (330a)
Total electricity for the above, kWh/year												138.7661 (331)
Electricity for lighting (calculated in Appendix L)												125.8946 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4194.2617 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1122.7431	0.1548	67.4114 (367)
Electrical energy for heat distribution (space & water)	15.2378	0.0000	5.7444 (372)
Overall CO2 factor for heat network			0.0432 (386)
Total CO2 associated with community systems			169.8691 (373)
Space and water heating			169.8691 (376)
Pumps, fans and electric keep-hot	138.7661	0.1387	19.2486 (378)
Energy for lighting	125.8946	0.1443	18.1705 (379)
Total CO2, kg/year			207.2882 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9900 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1122.7431	1.5732	684.9310 (467)
Electrical energy for heat distribution (space & water)	15.2378	0.0000	60.5469 (472)
Overall CO2 factor for heat network			0.4556 (486)
Total CO2 associated with community systems			1790.4595 (473)
Space and water heating			1790.4595 (476)
Pumps, fans and electric keep-hot	138.7661	1.5128	209.9254 (478)
Energy for lighting	125.8946	1.5338	193.1013 (479)
Total Primary energy kWh/year			2193.4862 (483)
Dwelling Primary energy Rate (DPER)			42.1800 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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

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	Jan 1.4061	Feb 1.4035	Mar 1.4010	Apr 1.3893	May 1.3871	Jun 1.3768	Jul 1.3768	Aug 1.3749	Sep 1.3808	Oct 1.3871	Nov 1.3915	Dec 1.3962 (40)
HLP HLP (average)												1.3893
Days in month	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												53.3405 (42a)
53.5457	52.7410	51.5684	49.3249	47.6692	45.8228	44.7733	45.9370	47.2127	49.1951	51.4869		
Hot water usage for baths												23.0714 (42b)
23.1496	22.8058	22.3217	21.4290	20.7606	20.0194	19.6190	20.0998	20.6232	21.4163	22.3274		
Hot water usage for other uses												32.5422 (42c)
32.5422	31.3589	30.1755	28.9922	27.8088	26.6255	26.6255	27.8088	28.9922	30.1755	31.3589		
Average daily hot water use (litres/day)												100.4145 (43)
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 content (annual)												170.5958 (45)
173.0055	152.2323	159.9449	136.5473	129.5556	113.6997	110.0781	116.2005	119.3987	136.7670	149.8384		
Energy content (annual)												1667.8640
Distribution loss (46)m = 0.15 x (45)m												
25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758		25.5894 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738		25.2896 (56)
If cylinder contains dedicated solar storage												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738		25.2896 (57)
Primary loss												23.2624 (59)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120		
Combi loss												0.0000 (61)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Total heat required for water heating calculated for each month												
221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243		219.1478 (62)
WWHRS												-24.0255 (63a)
-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857		
PV diverter												-0.0000 (63b)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		
Solar input												0.0000 (63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
FGHRS												0.0000 (63d)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Output from w/h												
197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386		195.1223 (64)
12Total per year (kWh/year)												2012.0777 (64)
Electric shower(s)												2012 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099		95.5647 (65)

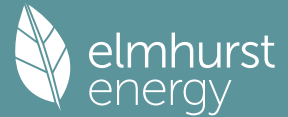
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	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 (70)
3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000		
Losses e.g. evaporation (negative values) (Table 5)												
-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628		-69.9628 (71)
Water heating gains (Table 5)												
129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027		128.4472 (72)
Total internal gains												
411.2450	419.0886	403.0040	388.6648	370.2261	354.3353	341.7289	342.8833	352.6458	367.5459	388.8997		403.4427 (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	524.2208	613.0859	672.5770	729.6138	758.4474	742.5336	714.8348	680.2963	646.8706	583.0698	524.5023	499.9428 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,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	0.8902	0.8533	0.8070	0.7312	0.6308	0.5042	0.3913	0.4211	0.5805	0.7530	0.8544	0.8985 (86)
MIT	17.9297	18.3444	18.9059	19.6053	20.2117	20.6551	20.8548	20.8255	20.5075	19.7253	18.7184	17.8529 (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	0.8765	0.8357	0.7834	0.6971	0.5810	0.4319	0.2975	0.3273	0.5114	0.7144	0.8339	0.8858 (89)
MIT 2	16.2840	16.7934	17.4822	18.3284	19.0338	19.5176	19.7021	19.6819	19.3757	18.4938	17.2720	16.1920 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	17.3518	17.7998	18.4060	19.1569	19.7980	20.2557	20.4500	20.4239	20.1101	19.2929	18.2105	17.2696 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3518	17.7998	18.4060	19.1569	19.7980	20.2557	20.4500	20.4239	20.1101	19.2929	18.2105	17.2696 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8419	0.8010	0.7525	0.6779	0.5820	0.4613	0.3506	0.3785	0.5314	0.6970	0.8016	0.8518 (94)
Useful gains	441.3467	491.0735	506.1453	494.6060	441.4524	342.5633	250.6230	257.4945	343.7715	406.3983	420.4165	425.8695 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	954.3033	941.4740	867.3892	740.9754	584.0883	404.9155	275.6388	287.6926	431.5203	626.9912	803.9409	948.8664 (97)
Space heating kWh	381.6397	302.6692	268.7655	177.3860	106.1210	0.0000	0.0000	0.0000	0.0000	164.1211	276.1376	389.1097 (98a)
Space heating requirement - total per year (kWh/year)	2065.9497											
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	381.6397	302.6692	268.7655	177.3860	106.1210	0.0000	0.0000	0.0000	0.0000	164.1211	276.1376	389.1097 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2065.9497											
Space heating per m ²	(98c) / (4) = 39.7298 (99)											

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	381.6397	302.6692	268.7655	177.3860	106.1210	0.0000	0.0000	0.0000	0.0000	164.1211	276.1376	389.1097 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	413.4774	327.9189	291.1869	192.1842	114.9740	0.0000	0.0000	0.0000	0.0000	177.8127	299.1739	421.5707 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	85.5156	85.2834	84.8865	84.2257	83.1530	79.8000	79.8000	79.8000	79.8000	84.0200	85.0638	79.8000 (216)
Fuel for water heating, kWh/month	230.4594	204.5374	218.9124	195.6192	193.1539	182.6008	181.2006	187.7579	189.0926	198.8332	207.0665	228.0090 (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)	-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)	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)	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)	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)	-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)	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)	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)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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												2238.2987	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2417.2429	(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												4356.7161	(238)

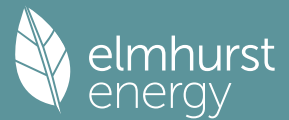
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2238.2987	0.2100	470.0427 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2417.2429	0.2100	507.6210 (264)
Space and water heating			977.6637 (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			941.5049 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.1100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2238.2987	1.1300	2529.2775 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2417.2429	1.1300	2731.4845 (278)
Space and water heating			5260.7620 (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			5046.2994 (286)
Target Primary Energy Rate (TPER)			97.0400 (287)

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Property Reference	Flat 403 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 403 VL - Be Green	Prop Type Ref		Flat 403 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	81 B	DER	4.00	TER	19.27	
Environmental	97 A	% DER < TER				79.24
CO ₂ Emissions (t/year)	0.19	DFEE	48.23	TFEE	54.42	
Compliance Check	See BREL	% DFEE < TFEE				11.38
% DPER < TPER	58.84	DPER	42.34	TPER	102.88	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)

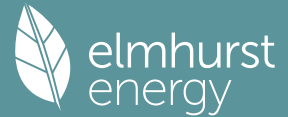
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	58.6002	58.4781	58.3559	57.7449	57.6228	57.0118	57.0118	56.8897	57.2562	57.6228	57.8671	58.1115 (39)
												57.7144
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
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)													
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1667.8640	
	25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894	(46)
Water storage loss:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716	(64)

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
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(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.8814	85.1187	76.8814	79.4441	76.8814	79.4441	76.8814	76.8814	79.4441	76.8814	79.4441	76.8814	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	(71)
Water heating gains (Table 5)	144.7110	142.7166	138.8741	130.4516	125.2928	119.9005	116.5882	119.3243	122.5323	128.5157	136.5895	143.6341	(72)
Total internal gains	423.2544	431.0790	415.0133	400.6682	382.2354	369.3387	356.7382	357.8927	367.6492	379.5553	400.9031	415.4520	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	11.2800	11.2829	0.4700	0.7000	0.7000	0.7700	29.0175 (75)
Southeast	5.8200	36.7938	0.4700	0.7000	0.7000	0.7700	48.8233 (77)
Northwest	1.8000	11.2829	0.4700	0.7000	0.7000	0.7700	4.6305 (81)

Solar gains	82.4713	151.6556	237.1887	343.6478	430.3325	447.1985	422.8332	355.1083	273.5739	175.6161	100.8169	69.2612 (83)
Total gains	505.7257	582.7346	652.2020	744.3160	812.5679	816.5372	779.5714	713.0009	641.2231	555.1714	501.7201	484.7132 (84)

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, n _{l,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	0.8808	0.8414	0.7823	0.6765	0.5456	0.4065	0.3060	0.3440	0.5207	0.7254	0.8408	0.8894 (86)	
MIT	18.5887	18.9576	19.4777	20.1116	20.5783	20.8493	20.9438	20.9247	20.7204	20.1044	19.2603	18.5253 (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	0.8679	0.8249	0.7600	0.6449	0.5030	0.3523	0.2416	0.2764	0.4634	0.6903	0.8216	0.8774 (89)	
MIT 2	17.1943	17.6507	18.2903	19.0548	19.5897	19.8838	19.9703	19.9585	19.7616	19.0698	18.0429	17.1200 (90)	
Living area fraction	18.0596	18.4617	19.0272	19.7106	20.2032	20.4829	20.5744	20.5581	f _{LA} = Living area / (4) =	19.7119	18.7984	0.6206 (91)	
MIT	18.0596	18.4617	19.0272	19.7106	20.2032	20.4829	20.5744	20.5581	20.3566	19.7119	18.7984	17.9921 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.0596	18.4617	19.0272	19.7106	20.2032	20.4829	20.5744	20.5581	20.3566	19.7119	18.7984	17.9921 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8379	0.7960	0.7364	0.6355	0.5122	0.3789	0.2790	0.3146	0.4846	0.6794	0.7948	0.8477 (94)	
Useful gains	423.7393	463.8315	480.2695	472.9806	416.2211	309.3881	217.5035	224.3063	310.7543	377.2094	398.7841	410.9046 (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	806.3175	793.0625	731.0348	624.2580	489.9788	335.3973	226.5891	236.5534	358.2302	525.0505	676.9535	801.4786 (97)	
Space heating kWh	284.6382	221.2432	186.5694	108.9197	54.8757	0.0000	0.0000	0.0000	0.0000	109.9938	200.2820	290.5870 (98a)	
Space heating requirement - total per year (kWh/year)												1457.1091	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	284.6382	221.2432	186.5694	108.9197	54.8757	0.0000	0.0000	0.0000	0.0000	109.9938	200.2820	290.5870 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1457.1091	
Space heating per m ²										(98c) / (4) =		28.0213 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (301)
Fraction of space heat from community system													1.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.0000 (306)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating:													
Space heating requirement	284.6382	221.2432	186.5694	108.9197	54.8757	0.0000	0.0000	0.0000	0.0000	109.9938	200.2820	290.5870 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													

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307a	284.6382	221.2432	186.5694	108.9197	54.8757	0.0000	0.0000	0.0000	0.0000	109.9938	200.2820	290.5870
Space heating requirement	284.6382	221.2432	186.5694	108.9197	54.8757	0.0000	0.0000	0.0000	0.0000	109.9938	200.2820	290.5870 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
310a	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716
Water heating fuel	235.6813	208.8427	222.6207	197.2013	192.2314	174.3537	172.7539	178.8763	180.0527	199.4428	210.4924	233.2716 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	13.0951	11.8279	13.0951	12.6727	13.0951	12.6727	13.0951	13.0951	12.6727	13.0951	12.6727	13.0951 (331)
Lighting	16.8931	13.5523	12.2023	8.9399	6.9055	5.6418	6.2994	8.1882	10.6356	13.9545	15.7616	17.3626 (332)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1457.1091 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2405.8210 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												14.5711 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												154.1846 (330a)
Total electricity for the above, kWh/year												154.1846 (331)
Electricity for lighting (calculated in Appendix L)												136.3368 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4153.4514 (338)

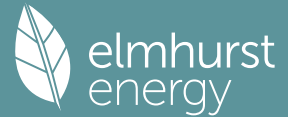
12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1103.6943	0.1549	64.4933 (367)
Electrical energy for heat distribution (space & water)	14.5711	0.0000	5.6422 (372)
Overall CO2 factor for heat network			0.0432 (386)
Total CO2 associated with community systems			166.8489 (373)
Space and water heating			166.8489 (376)
Pumps, fans and electric keep-hot	154.1846	0.1387	21.3873 (378)
Energy for lighting	136.3368	0.1443	19.6776 (379)
Total CO2, kg/year			207.9138 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0000 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1103.6943	1.5735	655.0830 (467)
Electrical energy for heat distribution (space & water)	14.5711	0.0000	59.5023 (472)
Overall CO2 factor for heat network			0.4555 (486)
Total CO2 associated with community systems			1759.5669 (473)
Space and water heating			1759.5669 (476)
Pumps, fans and electric keep-hot	154.1846	1.5128	233.2504 (478)
Energy for lighting	136.3368	1.5338	209.1179 (479)
Total Primary energy kWh/year			2201.9352 (483)
Dwelling Primary energy Rate (DPER)			42.3400 (484)

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

1. Overall dwelling characteristics

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

2. Ventilation rate

	m ³ 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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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)

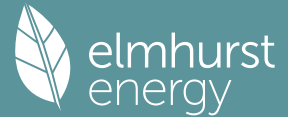
List of Thermal Bridges

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

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	Jan 1.5151	Feb 1.5125	Mar 1.5101	Apr 1.4984	May 1.4962	Jun 1.4860	Jul 1.4860	Aug 1.4841	Sep 1.4899	Oct 1.4962	Nov 1.5006	Dec 1.5052 (40)
HLP HLP (average)												1.4984
Days in month	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 content (annual)												
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)												
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)	
Distribution loss (46)m = 0.15 x (45)m												1667.8640
25.9508	22.8348	23.9917	20.4821	19.4333	17.0550	16.5117	17.4301	17.9098	20.5151	22.4758	25.5894 (46)	
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)	
If cylinder contains dedicated solar storage												
25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)	
Primary loss												
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
221.5576	196.0857	208.4970	183.5331	178.1076	160.6856	158.6302	164.7525	166.3845	185.3190	196.8243	219.1478 (62)	
WWHRS												
-24.4788	-21.6493	-22.6699	-18.7716	-17.4944	-14.9701	-14.0321	-14.9217	-15.4886	-18.2594	-20.6857	-24.0255 (63a)	
PV diverter												
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)	
12Total per year (kWh/year)												
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
96.3660	85.7000	92.0233	82.9906	81.9189	75.3938	75.4426	77.4783	77.2887	84.3166	87.4099	95.5647 (65)	

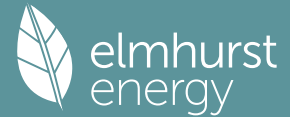
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535	87.4535 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	77.0079	85.2588	77.0079	79.5748	77.0079	79.5748	77.0079	77.0079	79.5748	77.0079	79.5748	77.0079 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	152.4259	154.0076	150.0218	141.5364	130.8251	120.7580	114.0326	112.4509	116.4367	124.9221	135.6334	145.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454	31.7454 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628	-69.9628 (71)
Water heating gains (Table 5)												
	129.5241	127.5297	123.6872	115.2648	110.1060	104.7137	101.4013	104.1375	107.3455	113.3288	121.4027	128.4472 (72)
Total internal gains												
	411.1941	419.0322	402.9530	388.6121	370.1751	354.2826	341.6779	342.8323	352.5931	367.4949	388.8470	403.3917 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				6.6300	11.2829	0.6300	0.7000		0.7700		22.8617 (75)	
Southeast				3.4200	36.7938	0.6300	0.7000		0.7700		38.4568 (77)	
Northwest				1.0600	11.2829	0.6300	0.7000		0.7700		3.6551 (81)	
Solar gains	64.9735	119.4818	186.8753	270.7613	339.0677	352.3596	333.1604	279.7938	215.5454	138.3607	79.4273	54.5659 (83)
Total gains	476.1676	538.5140	589.8283	659.3734	709.2427	706.6422	674.8383	622.6261	568.1386	505.8557	468.2743	457.9576 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.5278	14.5522	14.5762	14.6899	14.7114	14.8122	14.8122	14.8310	14.7732	14.7114	14.6680	14.6229
alpha	1.9685	1.9701	1.9717	1.9793	1.9808	1.9875	1.9875	1.9887	1.9849	1.9808	1.9779	1.9749
util living area	0.9093	0.8842	0.8465	0.7740	0.6711	0.5422	0.4303	0.4716	0.6445	0.8038	0.8825	0.9151 (86)
MIT	17.5480	17.9073	18.4954	19.2986	20.0253	20.5598	20.8040	20.7573	20.3355	19.4151	18.3606	17.4841 (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	0.8970	0.8688	0.8252	0.7411	0.6199	0.4639	0.3242	0.3651	0.5722	0.7679	0.8641	0.9036 (89)
MIT 2	15.7905	16.2338	16.9584	17.9332	18.7818	19.3666	19.5946	19.5624	19.1525	18.0988	16.8089	15.7136 (90)
Living area fraction									fLA = Living area / (4) =			0.6206 (91)
MIT	16.8812	17.2723	17.9122	18.7806	19.5534	20.1071	20.3452	20.3039	19.8866	18.9156	17.7719	16.8124 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8812	17.2723	17.9122	18.7806	19.5534	20.1071	20.3452	20.3039	19.8866	18.9156	17.7719	16.8124 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8616	0.8318	0.7894	0.7143	0.6140	0.4901	0.3794	0.4173	0.5839	0.7422	0.8290	0.8691 (94)
Useful gains	410.2571	447.9215	465.6066	470.9974	435.4460	346.3599	256.0129	259.8397	331.7528	375.4557	388.2168	397.9893 (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	991.1943	973.1086	896.1187	769.8421	611.0070	425.5431	289.3948	301.2816	448.3224	646.9669	832.7374	987.1905 (97)
Space heating kWh	432.2173	352.9257	320.3010	215.1682	130.6174	0.0000	0.0000	0.0000	0.0000	202.0044	320.0549	438.3657 (98a)
Space heating requirement - total per year (kWh/year)												2411.6546
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	432.2173	352.9257	320.3010	215.1682	130.6174	0.0000	0.0000	0.0000	0.0000	202.0044	320.0549	438.3657 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2411.6546
Space heating per m2										(98c) / (4) =		46.3780 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	432.2173	352.9257	320.3010	215.1682	130.6174	0.0000	0.0000	0.0000	0.0000	202.0044	320.0549	438.3657 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	468.2745	382.3680	347.0217	233.1183	141.5139	0.0000	0.0000	0.0000	0.0000	218.8563	346.7550	474.9358 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.0787	174.4364	185.8271	164.7616	160.6132	145.7155	144.5981	149.8308	150.8959	167.0596	176.1386	195.1223 (64)
Efficiency of water heater	85.7706	85.6064	85.2691	84.6594	83.6001	79.8000	79.8000	79.8000	79.8000	84.4868	85.3817	79.8000 (216)
Fuel for water heating, kWh/month	229.7743	203.7655	217.9300	194.6171	192.1207	182.6008	181.2006	187.7579	189.0926	197.7346	206.2954	227.3654 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)												

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(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)	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												2612.8435	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2410.2550	(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												4595.6760	(238)

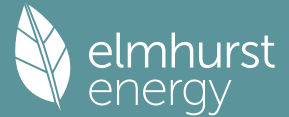
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2612.8435	0.2100	548.6971 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2410.2550	0.2100	506.1536 (264)
Space and water heating			1054.8507 (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			1002.0599 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.2700 (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	2612.8435	1.1300	2952.5132 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2410.2550	1.1300	2723.5882 (278)
Space and water heating			5676.1014 (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			5349.5514 (286)
Target Primary Energy Rate (TPER)			102.8800 (287)

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Property Reference	Flat 403 WCS - Green				Issued on Date	06/05/2023
Assessment Reference	Flat 403 WCS - Green	Prop Type Ref		Flat 102 WCS - Green		
Property	West Central Street, London, WC1A					
SAP Rating	82 B	DER	3.48	TER	15.55	
Environmental	97 A	% DER < TER				77.62
CO ₂ Emissions (t/year)	0.23	DFEE	44.07	TFEE	44.41	
Compliance Check	See BREL	% DFEE < TFEE				0.75
% DPER < TPER	55.30	DPER	37.09	TPER	82.97	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.0000 (1b)	x 2.5200 (2b)	= 181.4400 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.4400 (5)

2. Ventilation rate

	m ³ 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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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External Wall 1	68.5900	26.0200	42.5700	0.1500	6.3855	14.0000	595.9799 (29a)
External Roof 1	72.0000		72.0000	0.1000	7.2000	9.0000	648.0000 (30)
Total net area of external elements Aum(A, m2)			140.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.4691		(33)
Party Wall 1			9.5800	0.0000	0.0000	20.0000	191.6000 (32)
Corridor Wall			34.0200	0.0000	0.0000	20.0000	680.4000 (32)
Party Floor 1			72.0000			40.0000	2880.0000 (32d)
Internal Wall 1			88.7000			9.0000	798.3000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5794.2799 (34)

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

List of Thermal Bridges							
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			0.0000 (36a) =				
Total fabric heat loss			61.6198 (37)				

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)	
Average = Sum(39)m / 12 =	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)	
												73.8432	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

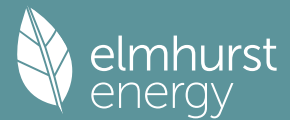
4. Water heating energy requirements (kWh/year)

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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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)													
Distribution loss (46)m = 0.15 x (45)m													1952.3920
	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:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)	
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month													
	265.1959	234.8125	249.9057	220.4949	214.3320	193.7493	191.5323	198.6995	200.4220	222.7752	236.0546	262.3752 (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	265.1959	234.8125	249.9057	220.4949	214.3320	193.7493	191.5323	198.6995	200.4220	222.7752	236.0546	262.3752 (64)	
													2690.3490 (64)
12Total per year (kWh/year)													2690 (64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	117.4786	104.5405	112.3946	101.6703	100.5663	92.7774	92.9854	95.3685	94.9961	103.3737	106.8439	116.5407 (65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)
Lighting gains	(calculated in Appendix L, equation L9 or L9a), also see Table 5												
	101.8450	112.7570	101.8450	105.2399	101.8450	105.2399	101.8450	101.8450	105.2399	101.8450	105.2399	101.8450	(67)
Appliances gains	(calculated in Appendix L, equation L13 or L13a), also see Table 5												
	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100	(68)
Cooking gains	(calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	(71)
Water heating gains (Table 5)													
	157.9013	155.5662	151.0680	141.2087	135.1698	128.8575	124.9804	128.1835	131.9390	138.9431	148.3943	156.6407	(72)
Total internal gains													
	519.0708	529.7430	509.0527	491.3477	467.7246	451.4712	435.2901	436.3979	448.8283	463.6782	490.7135	508.9010	(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	671.5976	796.7473	893.4899	999.7158	1066.3764	1058.6544	1015.3275	947.1135	875.8742	763.9275	674.7157	638.5843 (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, nil,m (see Table 9a)														
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	0.8845	0.8369	0.7738	0.6697	0.5437	0.4059	0.3030	0.3351	0.5029	0.7119	0.8404	0.8947	(86)	
MIT	18.7885	19.1908	19.6822	20.2426	20.6432	20.8764	20.9562	20.9428	20.7813	20.2477	19.4417	18.7175	(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	0.8723	0.8208	0.7520	0.6393	0.5034	0.3549	0.2431	0.2731	0.4494	0.6777	0.8219	0.8835	(89)	
MIT 2	17.4821	17.9791	18.5820	19.2585	19.7182	19.9735	20.0468	20.0388	19.8815	19.2842	18.3072	17.3989	(90)	
Living area fraction									fLA = Living area / (4) =			0.5421	(91)	
MIT	18.1903	18.6360	19.1784	19.7920	20.2196	20.4629	20.5398	20.5288	20.3693	19.8065	18.9222	18.1137	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.1903	18.6360	19.1784	19.7920	20.2196	20.4629	20.5398	20.5288	20.3693	19.8065	18.9222	18.1137	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8431	0.7927	0.7295	0.6300	0.5103	0.3768	0.2736	0.3040	0.4672	0.6675	0.7956	0.8547	(94)
Useful gains	566.2287	631.0600	651.8132	629.8614	544.2151	398.8790	277.8219	287.9180	409.2101	509.9019	536.8047	545.8076	(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	1043.2271	1029.2460	947.7989	804.7731	628.0015	427.0713	286.9825	300.0351	458.8511	678.6373	875.5599	1035.2978	(97)
Space heating kWh	354.8868	267.2141	220.2134	125.9364	62.3371	0.0000	0.0000	0.0000	0.0000	125.5391	243.9037	364.1807	(98a)
Space heating requirement - total per year (kWh/year)												1764.2113	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	354.8868	267.2141	220.2134	125.9364	62.3371	0.0000	0.0000	0.0000	0.0000	125.5391	243.9037	364.1807	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1764.2113	
Space heating per m2										(98c) / (4) =		24.5029	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
	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	0.8716	0.9097	0.8927	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	596.8167	490.3615	493.0422	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1181.6372	1133.3297	1054.7764	0.0000	0.0000	0.0000	0.0000	(103)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	421.0708	478.3683	417.9302	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	105.2677	119.5921	104.4825	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												329.3423 (107)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	354.8868	267.2141	220.2134	125.9364	62.3371	0.0000	0.0000	0.0000	0.0000	125.5391	243.9037	364.1807 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a	354.8868	267.2141	220.2134	125.9364	62.3371	0.0000	0.0000	0.0000	0.0000	125.5391	243.9037	364.1807
Space heating requirement	354.8868	267.2141	220.2134	125.9364	62.3371	0.0000	0.0000	0.0000	0.0000	125.5391	243.9037	364.1807 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)

Water heating

Annual water heating requirement	265.1959	234.8125	249.9057	220.4949	214.3320	193.7493	191.5323	198.6995	200.4220	222.7752	236.0546	262.3752 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	265.1959	234.8125	249.9057	220.4949	214.3320	193.7493	191.5323	198.6995	200.4220	222.7752	236.0546	262.3752
Water heating fuel	265.1959	234.8125	249.9057	220.4949	214.3320	193.7493	191.5323	198.6995	200.4220	222.7752	236.0546	262.3752 (310)
Cooling System Energy Efficiency Ratio												4.0300 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	26.1210	29.6755	25.9262	0.0000	0.0000	0.0000	0.0000 (315)
Pumps and Fa	16.3185	14.7393	16.3185	15.7921	16.3185	15.7921	16.3185	15.7921	16.3185	15.7921	16.3185	16.3185 (331)
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 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1764.2113 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2690.3490 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												17.6421 (313)
Space cooling fuel												81.7227 (321)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8680)												
mechanical ventilation fans (SFP = 0.8680)												192.1377 (330a)
Total electricity for the above, kWh/year												192.1377 (331)
Electricity for lighting (calculated in Appendix L)												151.4032 (332)

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

PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4879.8238 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1272.7315	0.1552	78.2272	(367)
Electrical energy for heat distribution (space & water)	17.6421	0.0000	6.5257	(372)
Overall CO2 factor for heat network			0.0433	(386)
Total CO2 associated with community systems			192.9757	(373)
Space and water heating			192.9757	(376)
Space cooling	81.7227	0.1142	9.3322	(377)
Pumps, fans and electric keep-hot	192.1377	0.1387	26.6519	(378)
Energy for lighting	151.4032	0.1443	21.8522	(379)

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Total CO₂, kg/year 250.8120 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER) 3.4800 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1272.7315	1.5745	793.6662 (467)
Electrical energy for heat distribution (space & water)	17.6421	0.0000	68.6876 (472)
Overall CO ₂ factor for heat network			0.4560 (486)
Total CO ₂ associated with community systems			2031.1895 (473)
Space and water heating			2031.1895 (476)
Space cooling	81.7227	1.4209	116.1165 (477)
Pumps, fans and electric keep-hot	192.1377	1.5128	290.6659 (478)
Energy for lighting	151.4032	1.5338	232.2273 (479)
Total Primary energy kWh/year			2670.1992 (483)
Dwelling Primary energy Rate (DPER)			37.0900 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.0000 (1b)	x 2.5200 (2b)	= 181.4400 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.4400 (5)

2. Ventilation rate

	m ³ 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)

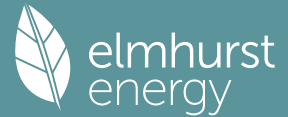
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1653 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4153 (18)
Number of sides sheltered	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (U _w = 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 A _{um} (A, m ²)			140.5900				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	37.3565	(33)
Party Wall 1	9.5800	0.0000	(32)
Corridor Wall	34.0200	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

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 content (annual)	202.5201	178.2021	187.2299	159.8409	151.6562	133.0953	128.8565	136.0237	139.7680	Total = Sum(45)m =		1952.3920 (45)
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:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	251.0721	222.0555	235.7819	206.8267	200.2082	180.0812	177.4085	184.5758	186.7538	208.6514	222.3865	248.2514 (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	222.4187	196.7142	209.2459	184.8539	179.7303	162.5581	160.9834	167.1093	168.6238	187.2781	198.1731	220.1286 (64)
	Total per year (kWh/year) = Sum(64)m =											2257.8175 (64)
12Total per year (kWh/year)												2258 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	106.1795	94.3349	101.0956	90.7358	89.2673	81.8429	81.6864	84.0695	84.0615	92.0747	95.9094	105.2417 (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)

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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	0.0000	0.0000	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)	142.7144	140.3794	135.8811	126.0219	119.9829	113.6706	109.7935	112.9967	116.7521	123.7563	133.2075	141.4538 (72)
Total internal gains	506.8896	517.5624	496.8715	479.1667	455.5434	436.2903	420.1089	421.2167	433.6473	451.4970	478.5325	496.7198 (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				4.4800	11.2829		0.6300		0.7000		0.7700		15.4480 (81)
Solar gains	136.2891	238.5762	343.4975	454.2172	534.8724	542.4900	518.2385	456.3102	381.5641	268.2792	164.4130	115.8779	(83)
Total gains	643.1787	756.1386	840.3690	933.3839	990.4159	978.7802	938.3474	877.5269	815.2114	719.7763	642.9456	612.5977	(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, nil,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	0.9073	0.8725	0.8258	0.7444	0.6355	0.5025	0.3893	0.4253	0.5969	0.7766	0.8747	0.9150 (86)
MIT	18.0019	18.4099	18.9751	19.6870	20.2848	20.7003	20.8768	20.8466	20.5379	19.7597	18.7702	17.9305 (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	0.8956	0.8571	0.8044	0.7123	0.5879	0.4339	0.3009	0.3359	0.5309	0.7412	0.8569	0.9042 (89)
MIT 2	16.3959	16.9019	17.6006	18.4678	19.1662	19.6222	19.7866	19.7659	19.4656	18.5787	17.3664	16.3103 (90)
Living area fraction									fLA = Living area / (4) =			0.5421 (91)
MIT	17.2665	17.7193	18.3457	19.1287	19.7726	20.2066	20.3776	20.3518	20.0469	19.2189	18.1273	17.1886 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2665	17.7193	18.3457	19.1287	19.7726	20.2066	20.3776	20.3518	20.0469	19.2189	18.1273	17.1886 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8617	0.8217	0.7713	0.6897	0.5846	0.4559	0.3426	0.3761	0.5429	0.7188	0.8233	0.8712 (94)
Ext temp.	554.1964	621.3084	648.1931	643.7692	578.9835	446.2382	321.4456	330.0397	442.5603	517.3573	529.3631	533.7022 (95)
Heat loss rate W	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)
Space heating kWh	1224.4498	1208.0406	1114.0143	952.7230	750.5385	516.8649	348.2518	363.7322	550.0307	801.3314	1029.0144	1216.6597 (97)
Space heating requirement - total per year (kWh/year)	498.6685	394.2840	346.5710	222.4467	127.6369	0.0000	0.0000	0.0000	0.0000	211.2767	359.7490	508.1204 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	498.6685	394.2840	346.5710	222.4467	127.6369	0.0000	0.0000	0.0000	0.0000	211.2767	359.7490	508.1204 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2668.7533
Space heating per m2										(98c) / (4) =		37.0660 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	498.6685	394.2840	346.5710	222.4467	127.6369	0.0000	0.0000	0.0000	0.0000	211.2767	359.7490	508.1204 (98)
Space heating fuel (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating efficiency (main heating system 2)	540.2692	427.1766	375.4832	241.0040	138.2848	0.0000	0.0000	0.0000	0.0000	228.9022	389.7606	550.5096 (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)

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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	222.4187	196.7142	209.2459	184.8539	179.7303	162.5581	160.9834	167.1093	168.6238	187.2781	198.1731	220.1286	(64)
Efficiency of water heater	85.8147	85.5871	85.1832	84.4760	83.3061	79.8000	79.8000	79.8000	79.8000	84.3308	85.3797	79.8000	(216)
(217)m	85.8147	85.5871	85.1832	84.4760	83.3061	79.8000	79.8000	79.8000	79.8000	84.3308	85.3797	85.8725	(217)
Fuel for water heating, kWh/month	259.1848	229.8410	245.6421	218.8242	215.7469	203.7069	201.7336	209.4102	211.3080	222.0754	232.1080	256.3434	(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)	-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)	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)
(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)	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)
(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)	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)
(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)	-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)	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)
(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)	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)
(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)	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)
(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												2891.3903	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2705.9245	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												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												5142.3528	(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	2891.3903	0.2100	607.1920 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2705.9245	0.2100	568.2441 (264)
Space and water heating			1175.4361 (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			1119.6371 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5500 (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	2891.3903	1.1300	3267.2711 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2705.9245	1.1300	3057.6947 (278)
Space and water heating			6324.9657 (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			5973.8984 (286)
Target Primary Energy Rate (TPER)			82.9700 (287)

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Property Reference	Flat 501 VL - Be Green				Issued on Date	06/05/2023
Assessment Reference	Flat 501 VL - Be Green	Prop Type Ref		Flat 501 VL - Be Green		
Property	MFMTF, Vine Lane, London, WC1A					
SAP Rating	81 B	DER	4.32	TER	20.35	
Environmental	97 A	% DER < TER				78.77
CO ₂ Emissions (t/year)	0.2	DFEE	54.71	TFEE	56.55	
Compliance Check	See BREL				% DFEE < TFEE	
% DPER < TPER	58.17	DPER	45.66	TPER	109.15	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.0000 (1b)	x 2.4700 (2b)	= 123.5000 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 123.5000 (5)

2. Ventilation rate

	m ³ 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)

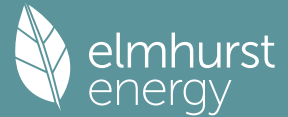
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (18)
	3 (19)
Shelter 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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)

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External Wall 1	75.3400	27.3300	48.0100	0.1500	7.2015	14.0000	672.1399 (29a)
External Roof 1	50.0000		50.0000	0.1000	5.0000	9.0000	450.0000 (30)
Total net area of external elements Aum(A, m2)			125.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	36.9967			(33)
Party Floor 1			50.0000			40.0000	2000.0000 (32d)
Internal Wall 1			47.7700			9.0000	429.9300 (32c)

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

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

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		17.5828 (36)
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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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)

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

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 content (annual)	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)
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:												172.0000 (47)
Store volume												1.6300 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Enter (49) or (54) in (55)												1.2714 (55)

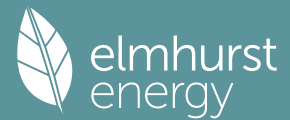
Total storage loss	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (56)
If cylinder contains dedicated solar storage	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (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	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (64)
Total per year (kWh/year) = Sum(64)m =												2375.0127 (64)

12Total per year (kWh/year)												2375 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	106.6024	94.9706	102.3400	93.0866	92.4222	85.6301	86.0656	88.0636	87.4899	94.7756	97.4242	105.8159 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)

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	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	143.2828	141.3252	137.5538	129.2869	124.2234	118.9307	115.6795	118.3651	121.5138	127.3866	135.3113	142.2257 (72)
Total internal gains	413.1308	420.6579	405.0796	391.0918	373.2064	360.6649	348.4420	349.5997	359.0740	370.6677	391.4143	405.5774 (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	490.0911	571.7956	665.1185	802.5403	915.5243	934.8931	887.1475	785.1928	670.6812	552.0635	487.2455	469.0772 (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, n _{l,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	0.8767	0.8373	0.7718	0.6538	0.5146	0.3803	0.2891	0.3336	0.5175	0.7264	0.8393	0.8851 (86)
MIT	18.0204	18.4367	19.0836	19.8819	20.4658	20.7975	20.9177	20.8872	20.6025	19.8077	18.7943	17.9482 (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	0.8631	0.8201	0.7482	0.6200	0.4699	0.3240	0.2216	0.2614	0.4563	0.6897	0.8194	0.8724 (89)
MIT 2	16.4644	16.9753	17.7633	18.7134	19.3738	19.7280	19.8377	19.8183	19.5485	18.6607	17.4333	16.3780 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.6400 (91)
MIT	17.4602	17.9106	18.6083	19.4612	20.0726	20.4125	20.5289	20.5024	20.2230	19.3948	18.3043	17.3829 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4602	17.9106	18.6083	19.4612	20.0726	20.4125	20.5289	20.5024	20.2230	19.3948	18.3043	17.3829 (93)

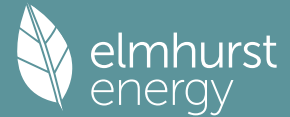
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8265	0.7840	0.7179	0.6066	0.4780	0.3513	0.2612	0.3022	0.4759	0.6720	0.7855	0.8363 (94)
Ext temp.	405.0709	448.2921	477.4873	486.8323	437.6649	328.3934	231.7125	237.2498	319.1739	371.0111	382.7223	392.2758 (95)
Heat loss rate W	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)
Space heating kWh	839.0720	827.9931	769.1351	664.6086	525.8919	361.6423	244.4498	254.7573	382.4172	552.4057	706.4064	834.2755 (97)
Space heating requirement - total per year (kWh/year)	322.8968	255.1591	216.9860	127.9989	65.6409	0.0000	0.0000	0.0000	0.0000	134.9576	233.0525	328.8478 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	322.8968	255.1591	216.9860	127.9989	65.6409	0.0000	0.0000	0.0000	0.0000	134.9576	233.0525	328.8478 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1685.5396
Space heating per m ²										(98c) / (4) =		33.7108 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement	322.8968	255.1591	216.9860	127.9989	65.6409	0.0000	0.0000	0.0000	0.0000	134.9576	233.0525	328.8478 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00	307a	322.8968	255.1591	216.9860	127.9989	65.6409	0.0000	0.0000	0.0000	134.9576	233.0525	328.8478
Space heating requirement	322.8968	255.1591	216.9860	127.9989	65.6409	0.0000	0.0000	0.0000	0.0000	134.9576	233.0525	328.8478 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)

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Space heating fuel for secondary/supplementary system												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating												
Annual water heating requirement												
	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203
Water heating fuel												
	232.4855	206.0307	219.6664	194.6791	189.8384	172.2536	170.7206	176.7299	177.8472	196.9164	207.7246	230.1203 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin												0.0000 (315)
Pumps and Fa												12.6943 (331)
Lighting												17.0281 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												0.0000 (333a)
(333a)m												0.0000 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												0.0000 (334a)
(334a)m												0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												0.0000 (335a)
(335a)m												0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												0.0000 (333b)
(333b)m												0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												0.0000 (334b)
(334b)m												0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												0.0000 (335b)
(335b)m												0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1685.5396 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2375.0127 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												16.8554 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.6000, SFP = 0.9920)												
mechanical ventilation fans (SFP = 0.9920)												149.4646 (330a)
Total electricity for the above, kWh/year												149.4646 (331)
Electricity for lighting (calculated in Appendix L)												133.7101 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												4343.7271 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1160.1578	0.1547	74.5064 (367)
Electrical energy for heat distribution (space & water)	16.8554	0.0000	5.9491 (372)
Overall CO2 factor for heat network			0.0433 (386)
Total CO2 associated with community systems			175.9226 (373)
Space and water heating			175.9226 (376)
Pumps, fans and electric keep-hot	149.4646	0.1387	20.7326 (378)
Energy for lighting	133.7101	0.1443	19.2985 (379)
Total CO2, kg/year			215.9537 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3200 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1160.1578	1.5728	757.4210 (467)
Electrical energy for heat distribution (space & water)	16.8554	0.0000	62.6147 (472)
Overall CO2 factor for heat network			0.4560 (486)
Total CO2 associated with community systems			1851.6065 (473)
Space and water heating			1851.6065 (476)
Pumps, fans and electric keep-hot	149.4646	1.5128	226.1101 (478)
Energy for lighting	133.7101	1.5338	205.0890 (479)
Total Primary energy kWh/year			2282.8057 (483)
Dwelling Primary energy Rate (DPER)			45.6600 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)
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 infiltr 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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	53.7995 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.7539	23.6228	23.4942	22.8906	22.7777	22.2520	22.2520	22.1546	22.4545	22.7777	23.0062	23.2450 (38)
Heat transfer coeff	77.5533	77.4222	77.2937	76.6901	76.5771	76.0514	76.0514	75.9541	76.2539	76.5771	76.8056	77.0445 (39)
Average = Sum(39)m / 12 =												76.6895

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5511	1.5484	1.5459	1.5338	1.5315	1.5210	1.5210	1.5191	1.5251	1.5315	1.5361	1.5409 (40)
HLP (average)												1.5338
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1637.0557
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)
Water storage loss:												
Store volume												172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	218.3618	193.2737	205.5426	181.0109	175.7146	158.5854	156.5969	162.6061	164.1790	182.7926	194.0564	215.9965 (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	194.3349	172.0242	183.2913	162.5860	158.5432	143.8918	142.8239	147.9599	148.9763	164.8704	173.7527	192.4146 (64)
												Total per year (kWh/year) = Sum(64)m = 1985.4693 (64)
12Total per year (kWh/year)												1985 (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	95.3034	84.7650	91.0410	82.1520	81.1232	74.6955	74.7665	76.7646	76.5554	83.4766	86.4896	94.5169 (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	74.4150	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	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)	128.0959	126.1384	122.3669	114.1000	109.0365	103.7438	100.4926	103.1782	106.3269	112.1998	120.1245	127.0389 (72)
Total internal gains	401.0964	408.6397	393.0451	379.0624	361.1719	345.6355	333.4075	334.5653	344.0446	358.6332	379.3849	393.5430 (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

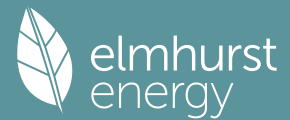
Northeast				4.7000	11.2829		0.6300		0.7000		0.7700		16.2066 (75)
Southeast				0.8300	36.7938		0.6300		0.7000		0.7700		9.3331 (77)
Northwest				5.0800	11.2829		0.6300		0.7000		0.7700		17.5169 (81)

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	444.1530	493.1826	538.4739	609.1269	664.3837	666.6774	634.5936	578.1191	518.2994	460.0935	432.9967		429.0705 (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, nil,m (see Table 9a)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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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	0.9046	0.8829	0.8473	0.7754	0.6726	0.5456	0.4374	0.4820	0.6556	0.8077	0.8795	0.9098 (86)
MIT	17.2458	17.5882	18.2020	19.0723	19.8765	20.4770	20.7573	20.6991	20.2088	19.2012	18.0972	17.1862 (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	0.8921	0.8677	0.8266	0.7432	0.6221	0.4675	0.3299	0.3743	0.5844	0.7729	0.8614	0.8981 (89)
MIT 2	15.4598	15.8795	16.6312	17.6815	18.6181	19.2761	19.5420	19.5009	19.0191	17.8630	16.5183	15.3883 (90)
Living area fraction									fLA = Living area / (4) =			0.6400 (91)
MIT	16.6028	16.9731	17.6365	18.5716	19.4235	20.0446	20.3198	20.2678	19.7805	18.7195	17.5288	16.5389 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6028	16.9731	17.6365	18.5716	19.4235	20.0446	20.3198	20.2678	19.7805	18.7195	17.5288	16.5389 (93)

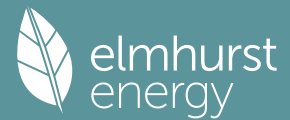
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8533	0.8273	0.7869	0.7119	0.6119	0.4911	0.3850	0.4256	0.5911	0.7426	0.8228	0.8600 (94)
Useful gains	378.9957	408.0085	423.7416	433.6470	406.5152	327.3752	244.3358	246.0661	306.3597	341.6851	356.2560	368.9932 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	954.1253	934.7238	860.7828	741.7148	591.4416	414.0730	282.8957	293.7721	433.1605	621.7653	800.9886	950.6471 (97)
Space heating kWh	427.8964	353.9527	325.1587	221.8088	137.5853	0.0000	0.0000	0.0000	0.0000	208.3797	320.2075	432.7505 (98a)
Space heating requirement - total per year (kWh/year)												2427.7396
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	427.8964	353.9527	325.1587	221.8088	137.5853	0.0000	0.0000	0.0000	0.0000	208.3797	320.2075	432.7505 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2427.7396
Space heating per m2										(98c) / (4) =		48.5548 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	427.8964	353.9527	325.1587	221.8088	137.5853	0.0000	0.0000	0.0000	0.0000	208.3797	320.2075	432.7505 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	463.5931	383.4807	352.2846	240.3129	149.0632	0.0000	0.0000	0.0000	0.0000	225.7635	346.9204	468.8521 (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	194.3349	172.0242	183.2913	162.5860	158.5432	143.8918	142.8239	147.9599	148.9763	164.8704	173.7527	192.4146 (64)
Efficiency of water heater	85.7785	85.6410	85.3307	84.7568	83.7434	79.8000	79.8000	79.8000	79.8000	84.5861	85.4116	79.8000 (216)
Fuel for water heating, kWh/month	226.5543	200.8666	214.8011	191.8264	189.3202	180.3155	178.9773	185.4134	186.6872	194.9142	203.4299	224.2047 (219)
Space cooling fuel requirement	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)	-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)	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)	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)	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)	-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)	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)	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)	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												2630.2704 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000

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Water heating fuel used	2377.3108 (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	4724.0930 (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	2630.2704	0.2100	552.3568 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2377.3108	0.2100	499.2353 (264)
Space and water heating			1051.5920 (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			1017.3578 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.3500 (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	2630.2704	1.1300	2972.2056 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2377.3108	1.1300	2686.3612 (278)
Space and water heating			5658.5667 (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			5457.5020 (286)
Target Primary Energy Rate (TPER)			109.1500 (287)

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Property Reference	House - 10-12 MS Green				Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref		House - 10-12 Museum Street		
Property	Museum Street, London, WC1A					
SAP Rating	74 C	DER	5.19	TER	12.46	
Environmental	95 A	% DER < TER				58.35
CO ₂ Emissions (t/year)	0.66	DFEE	91.99	TFEE	50.57	
Compliance Check	See BREL	% DFEE < TFEE				-81.90
% DPER < TPER	17.73	DPER	53.87	TPER	65.48	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)

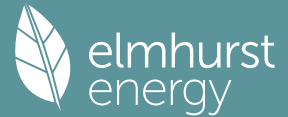
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	10.0000 (17)
Number of sides sheltered	0.5000 (18)
	3 (19)
Shelter 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
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	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)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
	310.9246												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

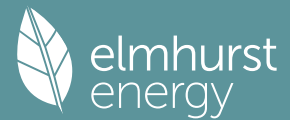
4. Water heating energy requirements (kWh/year)

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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
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:													
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6300 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2714 (55)
Total storage loss													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(56)
If cylinder contains dedicated solar storage													
	39.4134	35.5992	39.4134	38.1420	39.4134	38.1420	39.4134	39.4134	38.1420	39.4134	38.1420	39.4134	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	300.0035	265.4397	282.0839	247.9659	240.3961	216.6233	213.6783	222.0779	224.4443	250.2920	266.2012	296.6981	(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													
	300.0035	265.4397	282.0839	247.9659	240.3961	216.6233	213.6783	222.0779	224.4443	250.2920	266.2012	296.6981	(64)
Total per year (kWh/year)													3025.9041 (64)
Electric shower(s)													3026 (64)
	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													
	129.0521	114.7241	123.0938	110.8044	109.2326	100.3830	100.3490	103.1418	102.9835	112.5230	116.8676	127.9531	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
	-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)													

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Total internal gains	173.4571	170.7204	165.4487	153.8950	146.8180	139.4208	134.8776	138.6315	143.0326	151.2406	162.3162	171.9799 (72)
	724.6788	742.6823	711.5953	687.5427	652.4405	629.2054	605.0511	605.4660	623.6949	644.4018	683.5026	709.0042 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	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	953.3242	1152.0784	1324.6826	1535.9125	1683.6694	1688.5991	1611.5954	1470.1432	1317.4030	1111.1441	960.9963	902.3287 (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, nil,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	0.9966	0.9934	0.9868	0.9671	0.9197	0.8180	0.6907	0.7459	0.9080	0.9794	0.9941	0.9972 (86)
MIT	18.3443	18.5873	19.0030	19.6122	20.1874	20.6574	20.8648	20.8210	20.4408	19.6993	18.9401	18.3352 (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	0.9953	0.9909	0.9811	0.9512	0.8744	0.7016	0.4842	0.5523	0.8343	0.9665	0.9913	0.9961 (89)
MIT 2	16.2775	16.5912	17.1242	17.9088	18.6096	19.1341	19.2930	19.2778	18.9281	18.0317	17.0601	16.2787 (90)
Living area fraction									fLA = Living area / (4) =			0.0864 (91)
MIT	16.4561	16.7636	17.2866	18.0560	18.7460	19.2657	19.4288	19.4112	19.0588	18.1758	17.2226	16.4564 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4561	16.7636	17.2866	18.0560	18.7460	19.2657	19.4288	19.4112	19.0588	18.1758	17.2226	16.4564 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9914	0.9843	0.9702	0.9333	0.8534	0.6958	0.4989	0.5633	0.8176	0.9520	0.9852	0.9929 (94)
Useful gains	945.1506	1134.0023	1285.2664	1433.4112	1436.8417	1174.8935	804.0933	828.1959	1077.0869	1057.7831	946.8002	895.9151 (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	3900.1468	3790.0896	3431.2476	2849.9484	2183.5350	1413.9953	857.2969	908.4533	1516.3757	2347.7319	3164.6597	3865.2819 (97)
Space heating kWh	2198.5172	1784.8907	1596.6100	1019.9068	555.5397	0.0000	0.0000	0.0000	0.0000	959.7219	1596.8588	2209.2089 (98a)
Space heating requirement - total per year (kWh/year)												11921.2540
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	2198.5172	1784.8907	1596.6100	1019.9068	555.5397	0.0000	0.0000	0.0000	0.0000	959.7219	1596.8588	2209.2089 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11921.2540
Space heating per m2										(98c) / (4) =		78.8704 (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	0.5928	0.6771	0.6262	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1688.8319	1518.4014	1435.8044	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1884.1857	1797.6278	1634.3909	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	140.6548	207.7445	147.7484	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	35.1288	51.8846	36.9004	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												123.9138 (107)

9b. Energy requirements

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Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
2198.5172 1784.8907 1596.6100 1019.9068 555.5397 0.0000 0.0000 0.0000 0.0000 959.7219 1596.8588 2209.2089	(98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00		
307a 2198.5172 1784.8907 1596.6100 1019.9068 555.5397 0.0000 0.0000 0.0000 0.0000 959.7219 1596.8588 2209.2089		
Space heating requirement		
2198.5172 1784.8907 1596.6100 1019.9068 555.5397 0.0000 0.0000 0.0000 0.0000 959.7219 1596.8588 2209.2089	(307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(309)	
Water heating		
Annual water heating requirement		
300.0035 265.4397 282.0839 247.9659 240.3961 216.6233 213.6783 222.0779 224.4443 250.2920 266.2012 296.6981	(64)	
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00		
310a 300.0035 265.4397 282.0839 247.9659 240.3961 216.6233 213.6783 222.0779 224.4443 250.2920 266.2012 296.6981		
Water heating fuel		
300.0035 265.4397 282.0839 247.9659 240.3961 216.6233 213.6783 222.0779 224.4443 250.2920 266.2012 296.6981	(310)	
Cooling System Energy Efficiency Ratio		
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 8.1695 12.0662 8.5815 0.0000 0.0000 0.0000 4.3000	(314)	
Pumps and Fa 46.7158 42.1949 46.7158 45.2088 46.7158 45.2088 46.7158 46.7158 45.2088 46.7158 45.2088 46.7158	(315)	
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	(331)	
Electricity generated by PVs (Appendix M) (negative quantity)		
(333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(332)	
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(333a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(334a)	
Electricity generated by PVs (Appendix M) (negative quantity)		
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(335a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(333b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(334b)	
Annual totals kWh/year		
Space heating fuel - community heating	11921.2540	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	3025.9041	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	119.2125	(313)
Space cooling fuel	28.8172	(321)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)		
mechanical ventilation fans (SFP = 1.0540)		
Total electricity for the above, kWh/year	550.0403	(330a)
Electricity for lighting (calculated in Appendix L)	550.0403	(331)
	240.8043	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	15766.8199	(338)

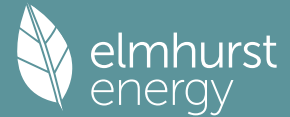
12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	4270.6166	0.1543	525.4711 (367)
Electrical energy for heat distribution (space & water)	119.2125	0.0000	22.6544 (372)
Overall CO2 factor for heat network			0.0448 (386)
Total CO2 associated with community systems			669.9218 (373)
Space and water heating			669.9218 (376)
Space cooling	28.8172	0.1138	3.2808 (377)
Pumps, fans and electric keep-hot	550.0403	0.1387	76.2974 (378)
Energy for lighting	240.8043	0.1443	34.7555 (379)
Total CO2, kg/year			784.2555 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.1900 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	4270.6166	1.5712	5351.5096 (467)
Electrical energy for heat distribution (space & water)	119.2125	0.0000	233.3244 (472)
Overall CO2 factor for heat network			0.4616 (486)

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Total CO2 associated with community systems			6899.7358 (473)
Space and water heating			6899.7358 (476)
Space cooling	28.8172	1.4197	40.9112 (477)
Pumps, fans and electric keep-hot	550.0403	1.5128	832.1010 (478)
Energy for lighting	240.8043	1.5338	369.3536 (479)
Total Primary energy kWh/year			8142.1016 (483)
Dwelling Primary energy Rate (DPER)			53.8700 (484)

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
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

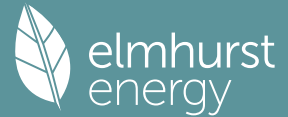
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	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, m ²)			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/m ² K							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)

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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)
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 content (annual)	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)
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:													
Store volume												172.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5107	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8158	(55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	285.8797	252.6828	267.9601	234.2978	226.2723	202.9551	199.5545	207.9541	210.7762	236.1682	252.5330	282.5743	(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	252.3031	222.9873	236.8647	208.5496	202.2759	182.4213	180.3073	187.4866	189.5310	211.1225	224.1593	249.6195	(64)
12Total per year (kWh/year)												2547.6281	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	117.7531	104.5185	111.7948	99.8699	97.9336	89.4485	89.0499	91.8428	92.0489	101.2240	105.9331	116.6540	(65)

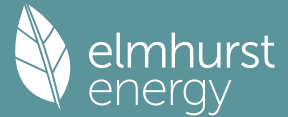
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(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)	158.2703	155.5335	150.2618	138.7082	131.6312	124.2340	119.6908	123.4446	127.8458	136.0537	147.1293	156.7931	(72)
Total internal gains	712.4920	730.4954	699.4084	675.3558	640.2536	614.0185	589.8643	590.2791	608.5081	632.2150	671.3157	696.8174	(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)

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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	944.8252	1146.4947	1322.3843	1537.4091	1688.1152	1690.4992	1612.6431	1468.9028	1313.4050	1106.4854	953.2851	893.2600 (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, nil,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	0.9975	0.9938	0.9839	0.9478	0.8534	0.6839	0.5224	0.5884	0.8344	0.9715	0.9947	0.9981 (86)	
MIT	19.3452	19.5661	19.9003	20.3486	20.7218	20.9275	20.9830	20.9716	20.8158	20.3196	19.7497	19.3082 (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	0.9967	0.9916	0.9780	0.9280	0.7999	0.5837	0.3921	0.4534	0.7543	0.9569	0.9924	0.9974 (89)	
MIT 2	17.9040	18.1871	18.6122	19.1726	19.5995	19.7976	19.8329	19.8295	19.7095	19.1489	18.4281	17.8609 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	18.0285	18.3063	18.7235	19.2742	19.6964	19.8952	19.9322	19.9282	19.8051	19.2501	18.5423	17.9859 (92)	
Temperature adjustment	0.0000												
adjusted MIT	18.0285	18.3063	18.7235	19.2742	19.6964	19.8952	19.9322	19.9282	19.8051	19.2501	18.5423	17.9859 (93)	

8. Space heating requirement													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9874	0.9701	0.9158	0.7926	0.5890	0.4031	0.4644	0.7518	0.9465	0.9885	0.9957 (94)	
Useful gains	939.7115	1132.0200	1282.7960	1407.9183	1338.0585	995.7582	650.0823	682.1812	987.4603	1047.3275	942.3307	889.4599 (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	2754.9931	2686.0894	2445.3289	2060.2861	1585.8995	1043.4783	656.6495	694.4373	1127.0246	1715.5305	2275.5870	2749.6154 (97)	
Space heating kWh	1350.5695	1044.3347	864.9244	469.7049	184.3937	0.0000	0.0000	0.0000	0.0000	497.1430	959.9445	1383.9557 (98a)	
Space heating requirement - total per year (kWh/year)	6754.9704												
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	1350.5695	1044.3347	864.9244	469.7049	184.3937	0.0000	0.0000	0.0000	0.0000	497.1430	959.9445	1383.9557 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	6754.9704												
Space heating per m2	(98c) / (4) =											44.6905 (99)	

9a. Energy requirements - Individual heating systems, including micro-CHP													

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												92.3000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1350.5695	1044.3347	864.9244	469.7049	184.3937	0.0000	0.0000	0.0000	0.0000	497.1430	959.9445	1383.9557 (98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)	
Space heating fuel (main heating system)	1463.2389	1131.4568	937.0795	508.8893	199.7765	0.0000	0.0000	0.0000	0.0000	538.6165	1040.0266	1499.4103 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	

Water heating													
Water heating requirement	252.3031	222.9873	236.8647	208.5496	202.2759	182.4213	180.3073	187.4866	189.5310	211.1225	224.1593	249.6195 (64)	
Efficiency of water heater (217)m	87.2511	87.0721	86.6979	85.8238	83.8528	79.8000	79.8000	79.8000	79.8000	85.9118	86.9437	79.8000 (216)	
Fuel for water heating, kWh/month	289.1691	256.0950	273.2070	242.9974	241.2274	228.5981	225.9489	234.9456	237.5075	245.7434	257.8212	285.9475 (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)													

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(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	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												7318.4945	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3019.2081	(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												8076.3935	(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	7318.4945	0.2100	1536.8838	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3019.2081	0.2100	634.0337	(264)
Space and water heating			2170.9175	(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			1883.1272	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4600	(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	7318.4945	1.1300	8269.8988	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3019.2081	1.1300	3411.7052	(278)
Space and water heating			11681.6039	(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			9897.1659	(286)
Target Primary Energy Rate (TPER)			65.4800	(287)

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Property Reference	House - 35 New OS Green				Issued on Date	06/05/2023
Assessment Reference	00001	Prop Type Ref	House - 10-12 Museum Street			
Property	Museum Street, London, WC1A					
SAP Rating	77 C	DER	4.63	TER	13.68	
Environmental	96 A	% DER < TER				66.15
CO ₂ Emissions (t/year)	0.4	DFEE	70.87	TFEE	39.83	
Compliance Check	See BREL	% DFEE < TFEE				-77.92
% DPER < TPER	35.09	DPER	48.39	TPER	74.55	
Assessor Details	Mr. Adrian Fell				Assessor ID	N222-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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

	m ³ 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)

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)

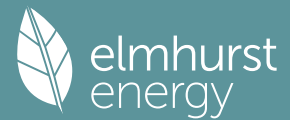
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4941	0.4844	0.4747	0.4263	0.4166	0.3681	0.3681	0.3584	0.3875	0.4166	0.4359	0.4553 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
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Water heating gains (Table 5)

169.4173	166.7849	161.7141	150.6005	143.7930	136.6776	132.3074	135.9182	140.1517	148.0470	158.7007	167.9964 (72)
Total internal gains	628.2877	642.5745	616.4556	595.1881	565.5667	545.5810	525.2420	526.1365	541.6338	559.6830	615.3166 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	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)

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	748.9981	861.7708	954.5871	1081.7065	1174.7034	1179.2264	1124.0614	1028.6095	930.1486	812.0392	740.1554	717.0808 (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, nil,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	0.9954	0.9916	0.9834	0.9556	0.8849	0.7354	0.5811	0.6421	0.8618	0.9705	0.9918	0.9962 (86)
MIT	18.9955	19.2089	19.5592	20.0867	20.5415	20.8604	20.9593	20.9401	20.7077	20.1273	19.5045	19.0009 (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	0.9938	0.9886	0.9769	0.9370	0.8338	0.6255	0.4227	0.4842	0.7810	0.9545	0.9882	0.9948 (89)
MIT 2	17.2974	17.5739	18.0234	18.7050	19.2439	19.5886	19.6552	19.6543	19.4515	18.7704	17.9751	17.3221 (90)
Living area fraction	17.5218	17.7900	18.2264	18.8876	19.4154	19.7567	19.8276	19.8242	19.6175	18.9497	18.1772	17.5440 (92)
MIT	17.5218	17.7900	18.2264	18.8876	19.4154	19.7567	19.8276	19.8242	19.6175	18.9497	18.1772	17.5440 (93)
Temperature adjustment												0.0000
adjusted MIT	17.5218	17.7900	18.2264	18.8876	19.4154	19.7567	19.8276	19.8242	19.6175	18.9497	18.1772	17.5440 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9899	0.9826	0.9676	0.9233	0.8238	0.6340	0.4432	0.5039	0.7783	0.9428	0.9823	0.9915 (94)
Useful gains	741.4416	846.7719	923.6173	998.7335	967.7164	747.5734	498.2269	518.3297	723.9718	765.5646	727.0655	710.9978 (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	2262.3076	2192.5329	1982.7882	1638.4603	1257.9290	814.7744	509.9652	537.5879	882.8988	1361.3469	1828.3785	2229.4126 (97)
Space heating kWh	1131.5243	904.3514	788.0231	460.6033	215.9182	0.0000	0.0000	0.0000	0.0000	443.2621	792.9454	1129.7006 (98a)
Space heating requirement - total per year (kWh/year)												5866.3283
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	1131.5243	904.3514	788.0231	460.6033	215.9182	0.0000	0.0000	0.0000	0.0000	443.2621	792.9454	1129.7006 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5866.3283
Space heating per m2										(98c) / (4) =		56.7124 (99)

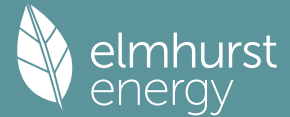
8c. Space cooling requirement

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	0.7419	0.8214	0.7772	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1101.8212	960.3545	927.2978	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1291.9593	1231.2012	1123.5350	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	136.8994	201.5099	146.0005	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	34.0793	50.1632	36.3449	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												120.5873 (107)

9b. Energy requirements

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)
Fraction of space heat from community system												1.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating:												
Space heating requirement												
1131.5243 904.3514 788.0231 460.6033 215.9182 0.0000 0.0000 0.0000 0.0000 443.2621 792.9454 1129.7006 (98)												
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00												
307a 1131.5243 904.3514 788.0231 460.6033 215.9182 0.0000 0.0000 0.0000 0.0000 443.2621 792.9454 1129.7006												
Space heating requirement												
1131.5243 904.3514 788.0231 460.6033 215.9182 0.0000 0.0000 0.0000 443.2621 792.9454 1129.7006 (307)												
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)
Space heating fuel for secondary/supplementary system												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (309)												
Water heating												
Annual water heating requirement												
290.9641 257.4860 273.7273 240.8318 233.6273 210.6830 207.9270 216.0066 218.2058 243.1460 258.3722 287.7846 (64)												
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00												
310a 290.9641 257.4860 273.7273 240.8318 233.6273 210.6830 207.9270 216.0066 218.2058 243.1460 258.3722 287.7846												
Water heating fuel												
290.9641 257.4860 273.7273 240.8318 233.6273 210.6830 207.9270 216.0066 218.2058 243.1460 258.3722 287.7846 (310)												
Cooling System Energy Efficiency Ratio												4.3000 (314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 7.9254 11.6659 8.4523 0.0000 0.0000 0.0000 0.0000 (315)												
Pumps and Fa 34.4279 31.0962 34.4279 33.3174 34.4279 33.3174 34.4279 33.3174 34.4279 33.3174 34.4279 33.3174 (331)												
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 (332)												
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (333a)												
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (334a)												
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (335a)												
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (333b)												
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (334b)												
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (335b)												
Annual totals kWh/year												
Space heating fuel - community heating												5866.3283 (307)
Space heating fuel - secondary												0.0000 (309)
Water heating fuel - community heating												2938.7620 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												58.6633 (313)
Space cooling fuel												28.0436 (321)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.0540)												
mechanical ventilation fans (SFP = 1.0540)												405.3613 (330a)
Total electricity for the above, kWh/year												405.3613 (331)
Electricity for lighting (calculated in Appendix L)												196.5451 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												9435.0403 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	2515.7401	0.1548	259.4941 (367)
Electrical energy for heat distribution (space & water)	58.6633	0.0000	13.2218 (372)
Overall CO2 factor for heat network			0.0444 (386)
Total CO2 associated with community systems			390.9872 (373)
Space and water heating			390.9872 (376)
Space cooling	28.0436	0.1138	3.1926 (377)
Pumps, fans and electric keep-hot	405.3613	0.1387	56.2286 (378)
Energy for lighting	196.5451	0.1443	28.3675 (379)
Total CO2, kg/year			478.7760 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6300 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	2515.7401	1.5732	2636.8177 (467)
Electrical energy for heat distribution (space & water)	58.6633	0.0000	136.9825 (472)

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Overall CO2 factor for heat network			0.4600 (486)
Total CO2 associated with community systems			4050.7694 (473)
Space and water heating			4050.7694 (476)
Space cooling			39.8125 (477)
Pumps, fans and electric keep-hot	28.0436	1.4197	613.2306 (478)
Energy for lighting	405.3613	1.5128	301.4675 (479)
Total Primary energy kWh/year	196.5451	1.5338	5005.2799 (483)
Dwelling Primary energy Rate (DPER)			48.3900 (484)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	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

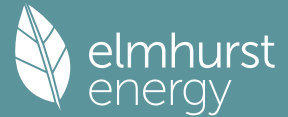
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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)
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

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Total fabric heat loss	(33) + (36) + (36a) =												59.3786 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	59.2286	58.9485	58.6739	57.3842	57.1429	56.0196	56.0196	55.8116	56.4523	57.1429	57.6311	58.1414	
Average = Sum(39)m / 12 =	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)
													116.7617
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	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)
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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2200.8050
Water storage loss:	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)
Store volume													172.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5107 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8158 (55)
Total storage loss	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(56)
If cylinder contains dedicated solar storage	25.2896	22.8422	25.2896	24.4738	25.2896	24.4738	25.2896	25.2896	24.4738	25.2896	24.4738	25.2896	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	276.8403	244.7290	259.6036	227.1637	219.5036	197.0149	193.8033	201.8829	204.5377	229.0222	244.7041	273.6608	(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	244.5422	216.1643	229.6923	202.3959	196.4209	177.2629	175.2889	182.1947	184.1015	204.9302	217.4108	241.9609	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2472.3657 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	114.7475	101.8739	109.0163	97.4978	95.6830	87.4733	87.1377	89.8241	89.9747	98.8480	103.3300	113.6903	(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	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)	-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)	154.2305	151.5980	146.5272	135.4136	128.6062	121.4907	117.1205	120.7313	124.9648	132.8601	143.5139	152.8095	(72)
Total internal gains	616.1008	630.3877	604.2687	583.0012	553.3799	530.3942	510.0552	510.9496	526.4470	547.4962	580.9638	603.1298	(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
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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	738.7582	853.1194	947.8540	1077.3668	1172.3413	1174.2596	1118.5329	1021.5270	921.2281	803.9226	730.3396	706.5353 (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, nil,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	0.9956	0.9904	0.9769	0.9263	0.8018	0.6062	0.4497	0.5101	0.7723	0.9550	0.9906	0.9965 (86)
MIT	19.7088	19.9001	20.1843	20.5685	20.8504	20.9722	20.9950	20.9908	20.9086	20.5378	20.0610	19.6803 (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	0.9942	0.9872	0.9691	0.9022	0.7456	0.5199	0.3485	0.4025	0.6913	0.9350	0.9869	0.9954 (89)
MIT 2	18.4683	18.7132	19.0732	19.5483	19.8582	19.9730	19.9866	19.9866	19.9248	19.5236	18.9270	18.4380 (90)
Living area fraction									fLA = Living area / (4) =			0.1322 (91)
MIT	18.6322	18.8700	19.2200	19.6831	19.9893	20.1050	20.1199	20.1193	20.0548	19.6576	19.0768	18.6022 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6322	18.8700	19.2200	19.6831	19.9893	20.1050	20.1199	20.1193	20.0548	19.6576	19.0768	18.6022 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9914	0.9825	0.9616	0.8938	0.7462	0.5303	0.3619	0.4166	0.6975	0.9268	0.9823	0.9930 (94)
Useful gains	732.4415	838.1952	911.4859	962.9491	874.7747	622.6588	404.7790	425.6027	642.5201	745.0954	717.4407	701.6244 (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	1699.9064	1653.0352	1501.6336	1259.0639	965.8856	635.2714	406.1853	428.4314	689.7484	1055.4046	1401.4062	1692.5460 (97)
Space heating kWh	719.7939	547.5725	439.0699	213.2026	67.7865	0.0000	0.0000	0.0000	0.0000	230.8701	492.4551	737.2456 (98a)
Space heating requirement - total per year (kWh/year)												3447.9964
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	719.7939	547.5725	439.0699	213.2026	67.7865	0.0000	0.0000	0.0000	0.0000	230.8701	492.4551	737.2456 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3447.9964
Space heating per m2										(98c) / (4) =		33.3333 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	719.7939	547.5725	439.0699	213.2026	67.7865	0.0000	0.0000	0.0000	0.0000	230.8701	492.4551	737.2456 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	779.8417	593.2530	475.6987	230.9888	73.4415	0.0000	0.0000	0.0000	0.0000	250.1301	533.5375	798.7493 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	244.5422	216.1643	229.6923	202.3959	196.4209	177.2629	175.2889	182.1947	184.1015	204.9302	217.4108	241.9609 (64)
Efficiency of water heater (217)m	86.3309	86.0531	85.4885	84.1766	81.9305	79.8000	79.8000	79.8000	79.8000	84.3277	85.8351	79.8000 (216)
Fuel for water heating, kWh/month	283.2614	251.1988	268.6820	240.4420	239.7410	222.1340	219.6603	228.3142	230.7037	243.0164	253.2889	280.0720 (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)												

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(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)	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)	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)
(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)	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)
(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)	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)
(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)	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)
(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												3735.6407	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2960.5147	(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												6735.5615	(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	3735.6407	0.2100	784.4845	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2960.5147	0.2100	621.7081	(264)
Space and water heating			1406.1926	(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			1415.1625	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6800	(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	3735.6407	1.1300	4221.2740	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2960.5147	1.1300	3345.3816	(278)
Space and water heating			7566.6555	(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			7711.0023	(286)
Target Primary Energy Rate (TPER)			74.5500	(287)