Full SAP Calculation Printout

Property Reference	Flat 4	**Issued on Date**	22/11/2023
Assessment Reference	001	**Prop Type Ref**	118 Malden Road
Property			

SAP Rating	82 B	**DER**	4.64	**TER**	12.87
Environmental	96 A	**% DER < TER**			63.95
CO_2 Emissions (t/year)	0.29	**DFEE**	33.07	**TFEE**	33.65
Compliance Check	See BREL	**% DFEE < TFEE**			1.74
% DPER < TPER	29.10	**DPER**	48.33	**TPER**	68.17

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.9500 (1b)	x	2.5000 (2b)	=	102.3750	(1b) - (3b)
First floor	33.4100 (1c)	x	2.7000 (2c)	=	90.2070	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.3600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.5820	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	80.1000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2621	0.2589	0.2557	0.2397	0.2366	0.2206	0.2206	0.2174	0.2270	0.2366	0.2429	0.2493	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Walls	63.4000	14.0000	49.4000	0.1800	8.8920	70.0000	3458.0001	(29a)
Dormer	13.2000		13.2000	0.1800	2.3760	9.0000	118.8000	(29a)
Mansard Walls	7.2000		7.2000	0.1800	1.2960	9.0000	64.8000	(29a)
Sloped C	35.0000		35.0000	0.1200	4.2000	9.0000	315.0000	(30)
Flat Roof	7.5400		7.5400	0.1200	0.9048	9.0000	67.8600	(30)
Total net area of external elements Aum(A, m2)			126.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.6993			(33)
Party Floor 1			40.9500			40.0000	1638.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	5662.4601 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		76.1493 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	8.4000	0.0300	0.2520	
E3 Sill	8.4000	0.0400	0.3360	
E4 Jamb	10.0000	0.0500	0.5000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
E7 Party floor between dwellings (in blocks of flats)	36.6000	0.0700	2.5620	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E11 Eaves (insulation at rafter level)	10.0000	0.0400	0.4000	
E13 Gable (insulation at rafter level)	6.1300	0.0400	0.2452	
P4 Party wall - Roof (insulation at ceiling level)	6.1300	0.4800	2.9424	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7376 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.4369 (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	16.6546	16.4520	16.2495	15.2366	15.0340	14.0212	14.0212	13.8186	14.4263	15.0340	15.4392	15.8443	(38)
Heat transfer coeff	59.0915	58.8890	58.6864	57.6735	57.4710	56.4581	56.4581	56.2555	56.8633	57.4710	57.8761	58.2813	(39)

Average = Sum(39)m / 12 = 57.6229

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7947	0.7919	0.7892	0.7756	0.7729	0.7593	0.7593	0.7565	0.7647	0.7729	0.7783	0.7838	(40)
HLP (average)												0.7749	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3472 (42)

Hot water usage for mixer showers

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

Hot water usage for baths

73.2964	72.2078	70.6749	67.8485	65.7321	63.3854	62.1178	63.6400	65.2974	67.8084	70.6931	73.0486	(42b)

Hot water usage for other uses

38.6673	37.2612	35.8551	34.4490	33.0430	31.6369	31.6369	33.0430	34.4490	35.8551	37.2612	38.6673	(42c)

Average daily hot water use (litres/day) 103.1094 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9637	109.4690	106.5300	102.2975	98.7751	95.0222	93.7547	96.6829	99.7464	103.6636	107.9543	111.7159	(44)
Energy conte	177.3231	155.8824	163.7327	140.0402	132.9702	116.8409	113.3881	119.7137	122.9973	140.6705	153.8007	174.9201	(45)
Energy content (annual)										Total = Sum(45)m =		1712.2799	
Distribution loss (46)m = 0.15 x (45)m	26.5985	23.3824	24.5599	21.0060	19.9455	17.5261	17.0082	17.9570	18.4496	21.1006	23.0701	26.2380	(46)

Water storage loss:

Store volume 173.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.0368 (55)

Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

209.4639	184.9128	195.8735	171.1442	165.1110	147.9449	145.5289	151.8545	154.1013	172.8113	184.9047	207.0609	(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

209.4639	184.9128	195.8735	171.1442	165.1110	147.9449	145.5289	151.8545	154.1013	172.8113	184.9047	207.0609	(64)
										Total per year (kWh/year) = Sum(64)m =	2090.7119	(64)

12Total per year (kWh/year) 2091 (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

58.9599	51.8309	54.4411	46.5634	44.2126	38.8496	37.7016	39.8048	40.8966	46.7729	51.1387	58.1609	(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	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0519	117.4146	106.0519	109.5870	106.0519	109.5870	106.0519	106.0519	109.5870	106.0519	109.5870	106.0519	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.2521	209.4027	203.9832	192.4457	177.8817	164.1935	155.0490	152.8984	158.3179	169.8554	184.4194	198.1076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	(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)	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	(71)
Water heating gains (Table 5)	79.2472	77.1293	73.1736	64.6713	59.4255	53.9578	50.6741	53.5011	56.8008	62.8669	71.0260	78.1733	(72)
Total internal gains	450.7587	462.1541	441.4161	424.9115	401.5666	385.9458	369.9825	370.6589	382.9132	396.9817	423.2399	440.5402	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.4000	10.6334	0.7200	0.7000	0.7700	31.1971	(74)
South	5.6000	46.7521	0.7200	0.7000	0.7700	91.4434	(78)

Solar gains	122.6406	209.3802	292.0765	378.3364	443.8863	450.8909	430.3555	378.9876	321.0853	232.5001	146.8774	105.0230	(83)
Total gains	573.3993	671.5343	733.4927	803.2479	845.4529	836.8367	800.3381	749.6464	703.9985	629.4818	570.1173	545.5633	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.6181	26.7097	26.8019	27.2726	27.3687	27.8597	27.8597	27.9600	27.6612	27.3687	27.1771	26.9882	
alpha	2.7745	2.7806	2.7868	2.8182	2.8246	2.8573	2.8573	2.8640	2.8441	2.8246	2.8118	2.7992	
util living area	0.8934	0.8465	0.7879	0.6842	0.5552	0.4086	0.3027	0.3343	0.5050	0.7191	0.8486	0.9034	(86)
MIT	19.2255	19.5787	19.9765	20.4406	20.7540	20.9263	20.9767	20.9688	20.8603	20.4521	19.7917	19.1723	(87)
Th 2	20.2580	20.2603	20.2627	20.2745	20.2769	20.2888	20.2888	20.2912	20.2840	20.2769	20.2722	20.2674	(88)
util rest of house	0.8836	0.8335	0.7703	0.6596	0.5224	0.3681	0.2561	0.2859	0.4622	0.6912	0.8337	0.8944	(89)
MIT 2	18.1645	18.6036	19.0953	19.6634	20.0282	20.2246	20.2726	20.2687	20.1562	19.6902	18.8840	18.1046	(90)
Living area fraction										fLA = Living area / (4) =		0.4371	(91)
MIT	18.6282	19.0298	19.4804	20.0031	20.3455	20.5313	20.5804	20.5747	20.4639	20.0232	19.2807	18.5713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6282	19.0298	19.4804	20.0031	20.3455	20.5313	20.5804	20.5747	20.4639	20.0232	19.2807	18.5713	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8579	0.8086	0.7497	0.6498	0.5256	0.3821	0.2754	0.3054	0.4732	0.6808	0.8102	0.8694	(94)
Useful gains	491.9193	542.9845	549.8872	521.9607	444.3398	319.7588	220.4031	228.9763	333.1536	428.5221	461.9182	474.2922	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	846.6768	832.0876	761.7733	640.3562	496.8632	334.8680	224.7242	234.8491	361.8748	541.5599	704.9739	837.5747	(97)
Space heating kWh	263.9396	194.2773	157.6432	85.2447	39.0774	0.0000	0.0000	0.0000	0.0000	84.1001	175.0001	270.2821	(98a)
Space heating requirement - total per year (kWh/year)												1269.5645	
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	263.9396	194.2773	157.6432	85.2447	39.0774	0.0000	0.0000	0.0000	0.0000	84.1001	175.0001	270.2821	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1269.5645	
Space heating per m2										(98c) / (4) =		17.0732	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	263.9396	194.2773	157.6432	85.2447	39.0774	0.0000	0.0000	0.0000	0.0000	84.1001	175.0001	270.2821	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	263.9396	194.2773	157.6432	85.2447	39.0774	0.0000	0.0000	0.0000	0.0000	84.1001	175.0001	270.2821	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	209.4639	184.9128	195.8735	171.1442	165.1110	147.9449	145.5289	151.8545	154.1013	172.8113	184.9047	207.0609	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	69.1403	61.0364	64.6543	56.4916	54.5002	48.8340	48.0365	50.1244	50.8661	57.0419	61.0337	68.3471	(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	13.2200	11.9406	13.2200	12.7935	13.2200	12.7935	13.2200	13.2200	12.7935	13.2200	12.7935	13.2200	(231)
Lighting	24.8502	19.9358	17.9499	13.1509	10.1581	8.2993	9.2666	12.0451	15.6453	20.5275	23.1858	25.5409	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	1269.5645	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	302.9550	
Water heating fuel used	690.1064	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)

mechanical ventilation fans (SFP = 0.6625)	155.6544	(230a)
Total electricity for the above, kWh/year	155.6544	(231)
Electricity for lighting (calculated in Appendix L)	200.5554	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2315.8807	(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	1269.5645	0.1556	197.4928	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	690.1064	0.1410	97.3262	(264)
Space and water heating			294.8190	(265)
Pumps, fans and electric keep-hot	155.6544	0.1387	21.5912	(267)
Energy for lighting	200.5554	0.1443	28.9463	(268)
Total CO2, kg/year			345.3565	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6400	(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	1269.5645	1.5759	2000.7013	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	690.1064	1.5215	1049.9878	(278)
Space and water heating			3050.6891	(279)
Pumps, fans and electric keep-hot	155.6544	1.5128	235.4740	(281)
Energy for lighting	200.5554	1.5338	307.6185	(282)
Total Primary energy kWh/year			3593.7815	(286)
Dwelling Primary energy Rate (DPER)			48.3300	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.9500 (1b)	x	2.5000 (2b)	=	102.3750	(1b) - (3b)
First floor	33.4100 (1c)	x	2.7000 (2c)	=	90.2070	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.3600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.5820	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1558	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4058	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3449	(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	0.4398	0.4311	0.4225	0.3794	0.3708	0.3277	0.3277	0.3190	0.3449	0.3708	0.3880	0.4053	(22b)
Effective ac	0.5967	0.5929	0.5893	0.5720	0.5687	0.5537	0.5537	0.5509	0.5595	0.5687	0.5753	0.5821	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Walls	63.4000	14.0000	49.4000	0.1800	8.8920			(29a)
Dormer	13.2000		13.2000	0.1800	2.3760			(29a)
Mansard Walls	7.2000		7.2000	0.1800	1.2960			(29a)
Sloped C	35.0000		35.0000	0.1100	3.8500			(30)
Flat Roof	7.5400		7.5400	0.1100	0.8294			(30)
Total net area of external elements Aum(A, m2)			126.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.2739			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 76.1493 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.4000	0.0500	0.4200
E3 Sill	8.4000	0.0500	0.4200
E4 Jamb	10.0000	0.0500	0.5000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
E7 Party floor between dwellings (in blocks of flats)	36.6000	0.0700	2.5620
E16 Corner (normal)	10.0000	0.0900	0.9000
E11 Eaves (insulation at rafter level)	10.0000	0.0400	0.4000
E13 Gable (insulation at rafter level)	6.1300	0.0800	0.4904
P4 Party wall - Roof (insulation at ceiling level)	6.1300	0.1200	0.7356

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0280 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 40.3019 (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	37.9212	37.6826	37.4487	36.3501	36.1445	35.1877	35.1877	35.0105	35.5562	36.1445	36.5603	36.9951	(38)
Heat transfer coeff	78.2231	77.9845	77.7506	76.6520	76.4465	75.4896	75.4896	75.3124	75.8582	76.4465	76.8623	77.2970	(39)
Average = Sum(39)m / 12 =												76.6510	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0520	1.0487	1.0456	1.0308	1.0281	1.0152	1.0152	1.0128	1.0201	1.0281	1.0337	1.0395	(40)
HLP (average)												1.0308	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3472 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	73.2964	72.2078	70.6749	67.8485	65.7321	63.3854	62.1178	63.6400	65.2974	67.8084	70.6931	73.0486	(42b)
Hot water usage for other uses	38.6673	37.2612	35.8551	34.4490	33.0430	31.6369	31.6369	33.0430	34.4490	35.8551	37.2612	38.6673	(42c)
Average daily hot water use (litres/day)												103.1094	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9637	109.4690	106.5300	102.2975	98.7751	95.0222	93.7547	96.6829	99.7464	103.6636	107.9543	111.7159	(44)
Energy conte	177.3231	155.8824	163.7327	140.0402	132.9702	116.8409	113.3881	119.7137	122.9973	140.6705	153.8007	174.9201	(45)
Energy content (annual)										Total = Sum(45)m =		1712.2799	
Distribution loss (46)m = 0.15 x (45)m	26.5985	23.3824	24.5599	21.0060	19.9455	17.5261	17.0082	17.9570	18.4496	21.1006	23.0701	26.2380	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	223.9180	197.9682	210.3276	185.1321	179.5651	161.9328	159.9830	166.3086	168.0891	187.2654	198.8925	221.5150	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	223.9180	197.9682	210.3276	185.1321	179.5651	161.9328	159.9830	166.3086	168.0891	187.2654	198.8925	221.5150	(64)
										Total per year (kWh/year) = Sum(64)m =		2260.8973	(64)
12Total per year (kWh/year)												2261	(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	96.2358	85.4995	91.7170	82.6368	81.4885	74.9231	74.9775	77.0807	76.9701	84.0489	87.2122	95.4368	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	117.3581	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.0519	117.4146	106.0519	109.5870	106.0519	109.5870	106.0519	106.0519	109.5870	106.0519	109.5870	106.0519	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.2521	209.4027	203.9832	192.4457	177.8817	164.1935	155.0490	152.8984	158.3179	169.8554	184.4194	198.1076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	34.7358	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	-93.8865	(71)
Water heating gains (Table 5)	129.3493	127.2314	123.2756	114.7734	109.5276	104.0598	100.7762	103.6031	106.9029	112.9689	121.1280	128.2753	(72)
Total internal gains													

	503.8607	515.2562	494.5182	478.0135	454.6686	436.0478	420.0846	420.7609	433.0152	450.0837	476.3419	493.6423	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.4000	10.6334	0.6300	0.7000	0.7700	27.2975	(74)
South	5.6000	46.7521	0.6300	0.7000	0.7700	80.0130	(78)

Solar gains	107.3105	183.2076	255.5670	331.0444	388.4005	394.5295	376.5611	331.6141	280.9496	203.4376	128.5177	91.8952	(83)
Total gains	611.1712	698.4638	750.0851	809.0579	843.0692	830.5774	796.6457	752.3750	713.9649	653.5213	604.8596	585.5374	(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	20.1079	20.1695	20.2301	20.5201	20.5753	20.8361	20.8361	20.8851	20.7348	20.5753	20.4639	20.3489	
alpha	2.3405	2.3446	2.3487	2.3680	2.3717	2.3891	2.3891	2.3923	2.3823	2.3717	2.3643	2.3566	
util living area	0.9023	0.8695	0.8274	0.7494	0.6415	0.5024	0.3852	0.4186	0.5895	0.7688	0.8674	0.9097	(86)
MIT	18.4834	18.8358	19.3058	19.9197	20.4270	20.7769	20.9145	20.8932	20.6534	20.0145	19.1732	18.4330	(87)
Th 2	20.0403	20.0429	20.0455	20.0577	20.0600	20.0707	20.0707	20.0727	20.0666	20.0600	20.0554	20.0505	(88)
util rest of house	0.8918	0.8559	0.8090	0.7224	0.6014	0.4453	0.3130	0.3457	0.5343	0.7381	0.8514	0.9000	(89)
MIT 2	17.1047	17.5449	18.1309	18.8887	19.4893	19.8832	20.0158	20.0008	19.7580	19.0194	17.9826	17.0477	(90)
Living area fraction									fLA = Living area / (4) =			0.4371	(91)
MIT	17.7073	18.1091	18.6444	19.3393	19.8991	20.2738	20.4086	20.3909	20.1493	19.4543	18.5030	17.6532	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7073	18.1091	18.6444	19.3393	19.8991	20.2738	20.4086	20.3909	20.1493	19.4543	18.5030	17.6532	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8589	0.8220	0.7772	0.6992	0.5940	0.4583	0.3400	0.3715	0.5395	0.7157	0.8191	0.8679	(94)
Useful gains	524.9113	574.1349	582.9385	565.6978	500.8225	380.6237	270.8842	279.5294	385.1618	467.7005	495.4587	508.1947	(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	1048.7575	1030.1033	944.2366	800.1931	626.7957	428.3106	287.5082	300.5607	458.8914	676.8811	876.4571	1039.8898	(97)
Space heating kWh	389.7416	306.4108	268.8058	168.8366	93.7240	0.0000	0.0000	0.0000	0.0000	155.6304	274.3188	395.5811	(98a)
Space heating requirement - total per year (kWh/year)												2053.0490	
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	389.7416	306.4108	268.8058	168.8366	93.7240	0.0000	0.0000	0.0000	0.0000	155.6304	274.3188	395.5811	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2053.0490	
Space heating per m2										(98c) / (4) =		27.6096	(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	389.7416	306.4108	268.8058	168.8366	93.7240	0.0000	0.0000	0.0000	0.0000	155.6304	274.3188	395.5811	(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)	422.2552	331.9727	291.2305	182.9215	101.5428	0.0000	0.0000	0.0000	0.0000	168.6136	297.2035	428.5819	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	223.9180	197.9682	210.3276	185.1321	179.5651	161.9328	159.9830	166.3086	168.0891	187.2654	198.8925	221.5150	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.2901	85.0357	84.6110	83.8537	82.6736	79.8000	79.8000	79.8000	79.8000	83.6478	84.7811	85.3448	(217)
Fuel for water heating, kWh/month	262.5370	232.8058	248.5818	220.7798	217.1977	202.9233	200.4800	208.4067	210.6380	223.8736	234.5952	259.5528	(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	22.0355	17.6777	15.9168	11.6613	9.0075	7.3592	8.2170	10.6808	13.8732	18.2024	20.5596	22.6479	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.8842	-29.4382	-44.4106	-52.4880	-58.8407	-55.7415	-55.0599	-50.8645	-43.8588	-34.7752	-22.3535	-17.0310	(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	-7.3352	-15.7549	-31.9272	-48.8652	-65.5142	-66.1593	-65.3826	-54.9457	-39.7327	-22.8292	-9.8882	-5.7767	(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	2224.3218	(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	2722.3717	(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)	177.8391	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-918.8573	(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	4291.6752	(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	2224.3218	0.2100	467.1076	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2722.3717	0.2100	571.6981	(264)
Space and water heating			1038.8056	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	177.8391	0.1443	25.6677	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-484.7460	0.1336	-64.7479	
PV Unit electricity exported	-434.1113	0.1253	-54.4143	
Total			-119.1622	(269)
Total CO2, kg/year			957.2404	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.8700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2224.3218	1.1300	2513.4836	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2722.3717	1.1300	3076.2800	(278)
Space and water heating			5589.7636	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	177.8391	1.5338	272.7755	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-484.7460	1.4936	-724.0153	
PV Unit electricity exported	-434.1113	0.4601	-199.7265	
Total			-923.7418	(283)
Total Primary energy kWh/year			5068.8982	(286)
Target Primary Energy Rate (TPER)			68.1700	(287)