Full SAP Calculation Printout

Property Reference	Plot 1	**Issued on Date**	21/12/2023
Assessment Reference	Plot 1 Baseline	**Prop Type Ref**	Plot 1 Be Green
Property	Plot 1 , 95, Avenue Road, London, NW8 6HY		

SAP Rating	72 C	**DER**	26.58	**TER**	11.18
Environmental	73 C	**% DER < TER**			-137.75
CO_2 Emissions (t/year)	3.4	**DFEE**	94.75	**TFEE**	50.08
Compliance Check	See BREL	**% DFEE < TFEE**			-89.21
% DPER < TPER	-151.75	**DPER**	148.31	**TPER**	58.91

Assessor Details	Mr. Graham Suttill	**Assessor ID**	P035-0001
Client	Carnell Warren Associates Ltd, Wendy Warren		

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	83.9900 (1b)	x	2.8000 (2b)	=	235.1720	(1b) - (3b)
First floor	71.7100 (1c)	x	3.2200 (2c)	=	230.9062	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	466.0782	(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		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(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) =	0.5813	(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	0.7411	0.7266	0.7120	0.6394	0.6248	0.5522	0.5522	0.5377	0.5813	0.6248	0.6539	0.6830	(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) =	75.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.8631	0.8486	0.8340	0.7614	0.7468	0.6742	0.6742	0.6597	0.7032	0.7468	0.7759	0.8050	(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	
Entrance Door			2.8800	1.6000	4.6080			(26)
Windows (Uw = 1.60)			31.7400	1.5038	47.7293			(27)
Glazed Doors (Uw = 1.60)			6.0200	1.5038	9.0526			(27)
Glazed Wall (Uw = 1.60)			27.6900	1.5038	41.6391			(27)
GF RL			4.1000	1.5038	6.1654			(27a)
1F RL			7.1700	1.5038	10.7820			(27a)
Basement Floor			83.9900	0.2500	20.9975	110.0000	9238.9000	(28)
Retaining Wall	69.0000		69.0000	0.3000	20.7000	9.0000	621.0000	(29a)
Existing External Wall	59.0100		59.0100	0.3000	17.7030	9.0000	531.0900	(29a)
New External Wall	94.0100	68.3300	25.6800	0.1800	4.6224	150.0000	3852.0000	(29a)
Flat Roof GF	12.3600	4.1000	8.2600	0.1500	1.2390	9.0000	74.3400	(30)
Flat Roof First Floor	71.7100	7.1700	64.5400	0.1500	9.6810	9.0000	580.8600	(30)
Total net area of external elements Aum(A, m2)			390.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		194.9193			(33)

Party Wall 1	54.5700	0.0000	0.0000	70.0000	3819.9000	(32)
Internal Wall 1	235.2600			75.0000	17644.5000	(32c)
Internal Floor 1	70.4800			18.0000	1268.6400	(32d)
Internal Ceiling 1	70.4800			9.0000	634.3200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	38265.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		245.7646 (35)
Thermal bridges (Default value 0.200 * total exposed area)		78.0160 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	272.9353 (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	132.7488	130.5138	128.2788	117.1039	114.8689	103.6940	103.6940	101.4590	108.1639	114.8689	119.3389	123.8089	(38)
Heat transfer coeff	405.6842	403.4492	401.2142	390.0392	387.8042	376.6293	376.6293	374.3943	381.0993	387.8042	392.2742	396.7442	(39)
Average = Sum(39)m / 12 =												389.4805	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.6056	2.5912	2.5768	2.5051	2.4907	2.4189	2.4189	2.4046	2.4477	2.4907	2.5194	2.5481	(40)
HLP (average)												2.5015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9428 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	82.7553	81.5117	79.6994	76.2320	73.6732	70.8196	69.1976	70.9961	72.9676	76.0315	79.5734	82.4383	(42a)
Hot water usage for baths	31.7566	31.2849	30.6208	29.3962	28.4792	27.4625	26.9133	27.5728	28.2909	29.3788	30.6286	31.6492	(42b)
Hot water usage for other uses	44.7668	43.1389	41.5111	39.8832	38.2553	36.6274	36.6274	38.2553	39.8832	41.5111	43.1389	44.7668	(42c)
Average daily hot water use (litres/day)												146.4381	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.2787	155.9356	151.8313	145.5114	140.4077	134.9095	132.7383	136.8242	141.1417	146.9215	153.3410	158.8543	(44)
Energy conte	252.2586	222.0502	233.3590	199.1979	189.0158	165.8869	160.5355	169.4169	174.0418	199.3710	218.4624	248.7275	(45)
Energy content (annual)										Total = Sum(45)m =		2432.3235	
Distribution loss (46)m = 0.15 x (45)m	37.8388	33.3075	35.0039	29.8797	28.3524	24.8830	24.0803	25.4125	26.1063	29.9057	32.7694	37.3091	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9720	(55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(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	305.6530	270.2774	286.7534	250.8699	242.4102	217.5589	213.9299	222.8113	225.7138	252.7654	270.1344	302.1219	(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	305.6530	270.2774	286.7534	250.8699	242.4102	217.5589	213.9299	222.8113	225.7138	252.7654	270.1344	302.1219	(64)
										Total per year (kWh/year) = Sum(64)m =		3060.9995	(64)
12Total per year (kWh/year)												3061	(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	126.5915	112.4134	120.3074	107.5709	105.5633	96.4950	96.0936	99.0467	99.2065	109.0064	113.9763	125.4174	(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	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	164.7608	182.4137	164.7608	170.2528	164.7608	170.2528	164.7608	164.7608	170.2528	164.7608	170.2528	164.7608	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.6567	330.0464	321.5045	303.3199	280.3650	258.7907	244.3778	240.9881	249.5300	267.7146	290.6694	312.2437	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	(71)
Water heating gains (Table 5)	170.1499	167.2819	161.7035	149.4040	141.8861	134.0208	129.1580	133.1272	137.7868	146.5140	158.3005	168.5718	(72)
Total internal gains	731.7088	749.8834	718.1102	693.1181	657.1534	630.2058	605.4380	606.0175	624.7110	649.1308	689.3642	715.7177	(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	
East	17.3900	19.6403	0.6300	0.7000	0.5400	73.2018	(76)
South	7.8500	46.7521	0.6300	0.7000	0.5400	78.6584	(78)
West	6.5000	19.6403	0.6300	0.7000	0.5400	27.3612	(80)
South	6.0200	46.7521	0.6300	0.7000	0.5400	60.3215	(78)
South	20.2300	46.7521	0.6300	0.7000	0.5400	202.7083	(78)
West	7.4600	19.6403	0.6300	0.7000	0.5400	31.4023	(80)
East	7.1700	26.0000	0.6300	0.7000	1.0000	73.9901	(82)
West	4.1000	26.0000	0.6300	0.7000	1.0000	42.3095	(82)

Solar gains	589.9532	1059.2948	1567.3815	2096.6505	2458.2488	2480.4289	2375.3854	2105.0327	1753.4900	1205.1196	717.1734	497.7063	(83)
Total gains	1321.6619	1809.1782	2285.4917	2789.7686	3115.4021	3110.6347	2980.8234	2711.0502	2378.2011	1854.2503	1406.5375	1213.4240	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.2010	26.3461	26.4929	27.2519	27.4090	28.2222	28.2222	28.3907	27.8912	27.4090	27.0967	26.7914	
alpha	2.7467	2.7564	2.7662	2.8168	2.8273	2.8815	2.8815	2.8927	2.8594	2.8273	2.8064	2.7861	
util living area	0.9909	0.9785	0.9528	0.8926	0.7901	0.6418	0.5053	0.5600	0.7769	0.9367	0.9833	0.9929	(86)
MIT	18.6339	18.9355	19.3813	19.9578	20.4112	20.7179	20.8295	20.8073	20.5625	19.9282	19.1907	18.6184	(87)
Th 2	18.9602	18.9683	18.9765	19.0179	19.0263	19.0687	19.0687	19.0772	19.0516	19.0263	19.0095	18.9929	(88)
util rest of house	0.9875	0.9704	0.9345	0.8497	0.7038	0.4945	0.3044	0.3563	0.6503	0.9016	0.9757	0.9902	(89)
MIT 2	16.3596	16.7462	17.3087	18.0316	18.5379	18.8532	18.9198	18.9214	18.7294	18.0279	17.1006	16.3602	(90)
Living area fraction										fLA = Living area / (4) =		0.1776	(91)
MIT	16.7637	17.1351	17.6769	18.3738	18.8707	19.1845	19.2590	19.2564	19.0551	18.3655	17.4719	16.7614	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.6137	16.9851	17.5269	18.2238	18.7207	19.0345	19.1090	19.1064	18.9051	18.2155	17.3219	16.6114	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9581	0.9152	0.8266	0.6871	0.4914	0.3090	0.3599	0.6380	0.8800	0.9650	0.9847	(94)
Useful gains	1296.2793	1733.3368	2091.6295	2306.0206	2140.6869	1528.6162	921.1402	975.6233	1517.2238	1631.6834	1357.3535	1194.8683	(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	4995.4591	4875.7376	4424.1469	3636.6320	2722.6642	1670.1442	944.9784	1013.2584	1831.2046	2953.3188	4009.7979	4924.1421	(97)
Space heating kWh	2752.1898	2111.6933	1735.3930	958.0402	432.9911	0.0000	0.0000	0.0000	0.0000	983.2968	1909.7600	2774.5797	(98a)
Space heating requirement - total per year (kWh/year)												13657.9438	
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	2752.1898	2111.6933	1735.3930	958.0402	432.9911	0.0000	0.0000	0.0000	0.0000	983.2968	1909.7600	2774.5797	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13657.9438	
Space heating per m2											(98c) / (4) =	87.7196	(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 %)												88.8000	(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	2752.1898	2111.6933	1735.3930	958.0402	432.9911	0.0000	0.0000	0.0000	0.0000	983.2968	1909.7600	2774.5797	(98)
Space heating efficiency (main heating system 1)	88.8000	88.8000	88.8000	88.8000	88.8000	0.0000	0.0000	0.0000	0.0000	88.8000	88.8000	88.8000	(210)
Space heating fuel (main heating system)	3099.3128	2378.0330	1954.2713	1078.8741	487.6026	0.0000	0.0000	0.0000	0.0000	1107.3162	2150.6306	3124.5267	(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	305.6530	270.2774	286.7534	250.8699	242.4102	217.5589	213.9299	222.8113	225.7138	252.7654	270.1344	302.1219	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8101	87.6780	87.4022	86.7692	85.3453	79.8000	79.8000	79.8000	79.8000	86.7982	87.5760	87.8273	(217)
Fuel for water heating, kWh/month	348.0841	308.2614	328.0851	289.1231	284.0346	272.6303	268.0825	279.2122	282.8494	291.2106	308.4570	343.9953	(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	64.0971	57.8942	64.0971	62.0295	64.0971	62.0295	64.0971	64.0971	62.0295	64.0971	62.0295	64.0971	(231)
Lighting	40.1373	32.1996	28.9922	21.2409	16.4071	13.4047	14.9671	19.4548	25.2699	33.1554	37.4490	41.2528	(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												15380.5674	(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												3604.0254	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.1760)		
mechanical ventilation fans (SFP = 1.1760)	668.6917	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	754.6917	(231)
Electricity for lighting (calculated in Appendix L)	323.9310	(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	20063.2154	(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	15380.5674	0.2100	3229.9191	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3604.0254	0.2100	756.8453	(264)
Space and water heating			3986.7645	(265)
Pumps, fans and electric keep-hot	754.6917	0.1387	104.6850	(267)
Energy for lighting	323.9310	0.1443	46.7532	(268)
Total CO2, kg/year			4138.2028	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			26.5800	(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	15380.5674	1.1300	17380.0411	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3604.0254	1.1300	4072.5487	(278)
Space and water heating			21452.5898	(279)
Pumps, fans and electric keep-hot	754.6917	1.5128	1141.6976	(281)
Energy for lighting	323.9310	1.5338	496.8561	(282)
Total Primary energy kWh/year			23091.1436	(286)
Dwelling Primary energy Rate (DPER)			148.3100	(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	83.9900 (1b)	x	2.8000 (2b)	=	235.1720	(1b) - (3b)
First floor	71.7100 (1c)	x	3.2200 (2c)	=	230.9062	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 155.7000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	466.0782	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0858	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3358	(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) =	0.2603	(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	0.3318	0.3253	0.3188	0.2863	0.2798	0.2472	0.2472	0.2407	0.2603	0.2798	0.2928	0.3058	(22b)
Effective ac	0.5551	0.5529	0.5508	0.5410	0.5391	0.5306	0.5306	0.5290	0.5339	0.5391	0.5429	0.5468	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.8800	1.0000	2.8800			(26)
TER Opening Type (Uw = 1.20)			30.7400	1.1450	35.1985			(27)
GF RL			1.9300	2.0221	3.9026			(27a)
1F RL			3.3700	2.0221	6.8143			(27a)
Basement Floor			83.9900	0.1300	10.9187			(28)
Retaining Wall	69.0000		69.0000	0.1800	12.4200			(29a)
Existing External Wall	59.0100		59.0100	0.1800	10.6218			(29a)
New External Wall	94.0100	33.6200	60.3900	0.1800	10.8702			(29a)
Flat Roof GF	12.3600	1.9300	10.4300	0.1100	1.1473			(30)
Flat Roof First Floor	71.7100	3.3700	68.3400	0.1100	7.5174			(30)
Total net area of external elements Aum(A, m2)			390.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.2908			(33)
Party Wall 1			54.5700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		245.7646 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		19.5040 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	121.7948 (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	85.3710	85.0422	84.7199	83.2060	82.9227	81.6041	81.6041	81.3600	82.1120	82.9227	83.4957	84.0948	(38)
Heat transfer coeff	207.1658	206.8370	206.5146	205.0007	204.7175	203.3989	203.3989	203.1548	203.9068	204.7175	205.2905	205.8896	(39)
Average = Sum(39)m / 12 =												204.9994	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3305	1.3284	1.3264	1.3166	1.3148	1.3064	1.3064	1.3048	1.3096	1.3148	1.3185	1.3223	(40)
HLP (average)												1.3166	
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		2.9428 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.5603	72.4548	70.8439	67.7618	65.4873	62.9507	61.5090	63.1077	64.8601	67.5836	70.7319	73.2785	(42a)

Hot water usage for baths

31.7566	31.2849	30.6208	29.3962	28.4792	27.4625	26.9133	27.5728	28.2909	29.3788	30.6286	31.6492	(42b)

Hot water usage for other uses

44.7668	43.1389	41.5111	39.8832	38.2553	36.6274	36.6274	38.2553	39.8832	41.5111	43.1389	44.7668	(42c)

Average daily hot water use (litres/day)	137.9606 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.0837	146.8787	142.9758	137.0412	132.2218	127.0406	125.0497	128.9357	133.0342	138.4735	144.4995	149.6945	(44)
Energy conte	237.6959	209.1533	219.7485	187.6025	177.9960	156.2113	151.2367	159.6494	164.0444	187.9072	205.8661	234.3854	(45)
Energy content (annual)										Total = Sum(45)m =		2291.4968	
Distribution loss (46)m = 0.15 x (45)m	35.6544	31.3730	32.9623	28.1404	26.6994	23.4317	22.6855	23.9474	24.6067	28.1861	30.8799	35.1578	(46)

Water storage loss:		
Store volume		300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		2.1127 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		1.1409 (55)

Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(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	296.3247	262.1084	278.3773	244.3401	236.6248	212.9488	209.8655	218.2782	220.7820	246.5361	262.6036	293.0142	(62)
WWHRS	-33.6287	-29.7415	-31.1436	-25.7881	-24.0336	-20.5657	-19.2771	-20.4992	-21.2781	-25.0845	-28.4177	-33.0059	(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	262.6960	232.3669	247.2337	218.5520	212.5912	192.3831	190.5885	197.7790	199.5039	221.4515	234.1859	260.0083	(64)
										Total per year (kWh/year) = Sum(64)m =		2669.3399	(64)
12Total per year (kWh/year)												2669	(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

125.9369	111.9075	119.9694	107.7679	106.0867	97.3303	97.1893	99.9865	99.9348	109.3822	113.8405	124.8362	(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	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	147.1381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	165.8884	183.6621	165.8884	171.4180	165.8884	171.4180	165.8884	165.8884	171.4180	165.8884	171.4180	165.8884	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.6567	330.0464	321.5045	303.3199	280.3650	258.7907	244.3778	240.9881	249.5300	267.7146	290.6694	312.2437	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	37.7138	(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)	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	-117.7105	(71)
Water heating gains (Table 5)	169.2701	166.5291	161.2492	149.6776	142.5897	135.1810	130.6307	134.3904	138.7984	147.0191	158.1118	167.7906	(72)
Total internal gains	731.9566	750.3790	718.7835	694.5569	658.9845	632.5312	608.0383	608.4084	626.8878	650.7635	690.3407	716.0642	(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	
East	8.1700	19.6403	0.6300	0.7000	0.5400	34.3910	(76)
South	16.0200	46.7521	0.6300	0.7000	0.5400	160.5233	(78)
West	6.5500	19.6403	0.6300	0.7000	0.5400	27.5717	(80)
East	3.3700	26.0000	0.6300	0.7000	1.0000	34.7764	(82)
West	1.9300	26.0000	0.6300	0.7000	1.0000	19.9164	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	277.1788	497.7007	736.4445	985.1581	1155.0893	1165.5220	1116.1591	989.1069	823.9003	566.2218	336.9528	233.8370	(83)
Total gains	1009.1354	1248.0797	1455.2280	1679.7150	1814.0739	1798.0532	1724.1974	1597.5153	1450.7880	1216.9853	1027.2935	949.9011	(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	51.3083	51.3898	51.4701	51.8502	51.9219	52.2585	52.2585	52.3213	52.1283	51.9219	51.7770	51.6263	
alpha	4.4206	4.4260	4.4313	4.4567	4.4615	4.4839	4.4839	4.4881	4.4752	4.4615	4.4518	4.4418	
util living area	0.9969	0.9918	0.9786	0.9355	0.8361	0.6674	0.5055	0.5619	0.8046	0.9629	0.9932	0.9977	(86)
MIT	19.3430	19.5866	19.9387	20.3845	20.7378	20.9310	20.9841	20.9750	20.8376	20.3518	19.7593	19.3016	(87)
Th 2	19.8170	19.8186	19.8202	19.8278	19.8292	19.8359	19.8359	19.8371	19.8333	19.8292	19.8264	19.8234	(88)
util rest of house	0.9959	0.9891	0.9711	0.9125	0.7800	0.5678	0.3786	0.4310	0.7199	0.9450	0.9904	0.9969	(89)
MIT 2	17.9022	18.2138	18.6602	19.2132	19.6127	19.7976	19.8311	19.8287	19.7249	19.1868	18.4411	17.8536	(90)
Living area fraction									fLA = Living area / (4) =			0.1776	(91)
MIT	18.1582	18.4577	18.8873	19.4213	19.8126	19.9989	20.0360	20.0323	19.9226	19.3937	18.6753	18.1108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1582	18.4577	18.8873	19.4213	19.8126	19.9989	20.0360	20.0323	19.9226	19.3937	18.6753	18.1108	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9844	0.9629	0.9025	0.7791	0.5828	0.4011	0.4540	0.7274	0.9360	0.9863	0.9950	(94)
Useful gains	1002.6773	1228.5885	1401.1945	1515.9241	1413.3766	1047.9312	691.5708	725.3383	1055.2914	1139.0697	1013.2023	945.1721	(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	2870.9425	2804.2241	2558.1567	2156.8697	1660.7884	1098.1406	698.8688	737.9189	1187.2676	1800.2315	2376.2942	2864.0948	(97)
Space heating kWh	1389.9893	1058.8271	860.7798	461.4809	184.0744	0.0000	0.0000	0.0000	0.0000	491.9044	981.4261	1427.6785	(98a)
Space heating requirement - total per year (kWh/year)												6856.1605	
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	1389.9893	1058.8271	860.7798	461.4809	184.0744	0.0000	0.0000	0.0000	0.0000	491.9044	981.4261	1427.6785	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6856.1605	
Space heating per m2										(98c) / (4) =		44.0344	(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	1389.9893	1058.8271	860.7798	461.4809	184.0744	0.0000	0.0000	0.0000	0.0000	491.9044	981.4261	1427.6785	(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)	1505.9472	1147.1583	932.5892	499.9793	199.4305	0.0000	0.0000	0.0000	0.0000	532.9408	1063.3003	1546.7807	(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	262.6960	232.3669	247.2337	218.5520	212.5912	192.3831	190.5885	197.7790	199.5039	221.4515	234.1859	260.0083	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.2361	87.0335	86.6202	85.6939	83.7384	79.8000	79.8000	79.8000	79.8000	85.7961	86.9116	87.2834	(217)
Fuel for water heating, kWh/month	301.1321	266.9855	285.4228	255.0380	253.8753	241.0816	238.8327	247.8433	250.0049	258.1136	269.4529	297.8897	(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	34.4683	27.6518	24.8974	18.2409	14.0898	11.5115	12.8532	16.7070	21.7008	28.4726	32.1597	35.4263	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-71.2204	-96.8715	-134.3562	-145.5179	-152.2831	-140.3641	-138.4393	-132.7890	-122.3767	-107.8863	-76.9485	-61.9807	(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	-51.7575	-107.3120	-210.5395	-312.3981	-409.5550	-410.3862	-405.7225	-345.2637	-255.2915	-152.3715	-68.7200	-41.0649	(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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	7428.1262	(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	3165.6723	(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)	278.1792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4151.4162	(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	6806.5615	(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	7428.1262	0.2100	1559.9065	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3165.6723	0.2100	664.7912	(264)
Space and water heating			2224.6977	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	278.1792	0.1443	40.1499	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1381.0338	0.1354	-186.9827	
PV Unit electricity exported	-2770.3824	0.1262	-349.7574	
Total			-536.7401	(269)
Total CO2, kg/year			1740.0367	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1800	(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	7428.1262	1.1300	8393.7826	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3165.6723	1.1300	3577.2096	(278)
Space and water heating			11970.9923	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	278.1792	1.5338	426.6805	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1381.0338	1.5004	-2072.1520	
PV Unit electricity exported	-2770.3824	0.4634	-1283.8921	
Total			-3356.0441	(283)
Total Primary energy kWh/year			9171.7295	(286)
Target Primary Energy Rate (TPER)			58.9100	(287)