

# Full SAP Calculation Printout



Property Reference	10 Pickett's Lock		Issued on Date	15/01/2024	
Assessment Reference	02 Be Lean + Clean	Prop Type Ref	New build		
Property	New build at, 10, Pickett's Lock Lane, London, N9 0AY				
SAP Rating	86 B	DER	11.20	TER	10.05
Environmental	89 B	% DER < TER			-11.44
CO <sub>2</sub> Emissions (t/year)	1.29	DFEE	38.51	TFEE	39.45
Compliance Check	See BREL	% DFEE < TFEE			2.39
% DPER < TPER	-22.09	DPER	64.05	TPER	52.46
Assessor Details	Mr. Thomas McMahon			Assessor ID	R863-0001
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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	60.3400 (1b)	x 2.4000 (2b)	= 144.8160 (1b) - (3b)
First floor	44.0500 (1c)	x 2.6100 (2c)	= 114.9705 (1c) - (3c)
Second floor	32.5100 (1d)	x 2.2800 (2d)	= 74.1228 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	333.9093 (5)

### 2. Ventilation rate

		m <sup>3</sup> 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		5.0000 (17)
Infiltration rate		0.2500 (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) =	0.1938 (21)
Wind speed	Jan 5.1000, Feb 5.0000, Mar 4.9000, Apr 4.4000, May 4.3000, Jun 3.8000, Jul 3.8000, Aug 3.7000, Sep 4.0000, Oct 4.3000, Nov 4.5000, Dec 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	0.2470, 0.2422, 0.2373, 0.2131, 0.2083, 0.1841, 0.1841, 0.1792, 0.1938, 0.2083, 0.2180, 0.2277	(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	0.3240, 0.3192, 0.3143, 0.2901, 0.2853, 0.2611, 0.2611, 0.2562, 0.2707, 0.2853, 0.2950, 0.3047	(25)

### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Glazing (Uw = 1.20)			23.0000	1.1450	26.3359		(27)
Door			1.9000	1.2000	2.2800		(26a)
N RW			2.3100	1.1450	2.6450		(27a)
Ground Floor			60.3400	0.1200	7.2408	110.0000	6637.4000 (28a)
External Wall	169.0400	22.3700	146.6700	0.1600	23.4672	60.0000	8800.2000 (29a)
Dormer Walls	17.4900	2.5300	14.9600	0.1700	2.5432	9.0000	134.6400 (29a)
Dwarf Walls (0.72)	10.1500		10.1500	0.1200	1.2180	9.0000	91.3500 (29a)
Joisted Roof	16.2900		16.2900	0.1100	1.7919	9.0000	146.6100 (30)
Rafter Roof	29.3500	2.3100	27.0400	0.1600	4.3264	9.0000	243.3600 (30)
Rafter Eaves (0.72)	7.6200		7.6200	0.1200	0.9144	9.0000	68.5800 (30)
Flat Dormer Roof	12.0600		12.0600	0.1400	1.6884	9.0000	108.5400 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			322.3400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	74.4512	(33)

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Internal Wall	171.7200	9.0000	1545.4800 (32c)
Internal Floor 1	44.0500	18.0000	792.9000 (32d)
Internal Floor 2	32.5100	18.0000	585.1800 (32d)
Internal Ceiling 1	44.0500	9.0000	396.4500 (32e)
Internal Ceiling 2	32.5100	9.0000	292.5900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19843.2800 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 144.9473 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.5800	0.0700	1.0206
E2 Other lintels (including other steel lintels)	2.3000	1.0000	2.3000
E3 Sill	8.0900	0.0220	0.1780
E3 Sill	2.3000	0.1000	0.2300
E4 Jamb	22.6200	0.0180	0.4072
E4 Jamb	4.4000	0.1000	0.4400
E5 Ground floor (normal)	33.6200	0.0500	1.6810
E6 Intermediate floor within a dwelling	27.3800	0.0010	0.0274
E10 Eaves (insulation at ceiling level)	17.3600	0.0580	1.0069
E24 Eaves (insulation at ceiling level - inverted)	15.4300	0.1500	2.3145
E11 Eaves (insulation at rafter level)	10.2800	0.0210	0.2159
E12 Gable (insulation at ceiling level)	4.3400	0.0350	0.1519
E13 Gable (insulation at rafter level)	22.3600	0.0280	0.6261
E16 Corner (normal)	23.6000	0.0350	0.8260
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0660	-0.3168
R1 Head of roof window	2.1000	0.2400	0.5040
R2 Sill of roof window	2.1000	0.2400	0.5040
R3 Jamb of roof window	6.6000	0.2400	1.5840
R6 Flat ceiling	16.4900	0.1200	1.9788
R7 Flat ceiling (inverted)	7.7400	0.1200	0.9288
R9 Roof to wall (flat ceiling)	10.0000	0.3200	3.2000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.8082 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 94.2594 (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
	35.7050	35.1713	34.6376	31.9689	31.4352	28.7665	28.7665	28.2328	29.8340	31.4352	32.5026	33.5701 (38)

Heat transfer coeff 129.9644 129.4307 128.8969 126.2283 125.6945 123.0259 123.0259 122.4921 124.0933 125.6945 126.7620 127.8295 (39)  
 Average = Sum(39)m / 12 = 126.0948

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9493	0.9454	0.9415	0.9220	0.9181	0.8987	0.8987	0.8948	0.9065	0.9181	0.9259	0.9337 (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 2.9109 (42)

Hot water usage for mixer showers 73.0267 71.9292 70.3300 67.2703 65.0122 62.4941 61.0628 62.6499 64.3896 67.0933 70.2188 72.7469 (42a)

Hot water usage for baths 31.5271 31.0589 30.3995 29.1838 28.2735 27.2641 26.7188 27.3736 28.0865 29.1666 30.4073 31.4205 (42b)

Hot water usage for other uses 44.4409 42.8249 41.2088 39.5928 37.9768 36.3607 36.3607 37.9768 39.5928 41.2088 42.8249 44.4409 (42c)

Average daily hot water use (litres/day) 136.9596 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	148.9947	145.8130	141.9384	136.0469	131.2625	126.1189	124.1423	128.0002	132.0689	137.4687	143.4510	148.6083 (44)
Energy conte	235.9712	207.6357	218.1540	186.2413	176.7045	155.0779	150.1394	158.4910	162.8541	186.5438	204.3723	232.6847 (45)
Energy content (annual)	Total = Sum(45)m = 2274.8699											
Distribution loss (46)m = 0.15 x (45)m	35.3957	31.1454	32.7231	27.9362	26.5057	23.2617	22.5209	23.7736	24.4281	27.9816	30.6558	34.9027 (46)
Water storage loss:	0.0000											
Total storage loss	0.0000 (56)											
If cylinder contains dedicated solar storage	0.0000											
Primary loss	0.0000 (57)											
Combi loss	0.0000 (59)											
Total heat required for water heating calculated for each month	268.0026	236.5619	250.1676	217.1974	208.6767	186.0027	182.0850	190.4449	193.7868	218.5258	235.3465	264.7128 (62)
WWHRS	0.0000 (63a)											
PV diverter	0.0000 (63b)											
Solar input	0.0000 (63c)											
FGHRS	0.0000 (63d)											
Output from w/h	268.0026	236.5619	250.1676	217.1974	208.6767	186.0027	182.0850	190.4449	193.7868	218.5258	235.3465	264.7128 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 2651.5107 (64)											2652 (64)
Electric shower(s)	0.0000 (64a)											
Heat gains from water heating, kWh/month	86.4683	76.2704	80.5396	69.6643	66.7473	59.2946	57.9077	60.6867	61.8822	70.0213	75.6973	85.3747 (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
	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.5024	173.2705	156.5024	161.7191	156.5024	161.7191	156.5024	156.5024	161.7191	156.5024	161.7191	156.5024 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.8589	309.0328	301.0348	284.0079	262.5146	242.3139	228.8186	225.6447	233.6428	250.6696	272.1629	292.3636 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547 (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)	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375 (71)
Water heating gains (Table 5)	116.2208	113.4976	108.2522	96.7559	89.7141	82.3536	77.8330	81.5682	85.9475	94.1147	105.1352	114.7509 (72)
Total internal gains												

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648.2462 665.4650 635.4534 612.1470 578.3951 553.0507 529.8180 530.3794 547.9734 570.9507 608.6813 633.2810 (73)

## 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W					
North		5.9000	10.6334	0.6300	0.7000	0.7700	19.1732 (74)					
South		16.0200	46.7521	0.6300	0.7000	0.7700	228.8944 (78)					
West		1.0800	19.6403	0.6300	0.7000	0.7700	6.4825 (80)					
North		2.3100	15.6897	0.6300	0.7000	1.0000	14.3849 (82)					
Solar gains	268.9351	451.1743	609.0365	757.2554	862.5378	865.8025	830.5365	748.4278	658.6948	495.4351	320.6168	231.2591 (83)
Total gains	917.1812	1116.6392	1244.4898	1369.4024	1440.9329	1418.8532	1360.3545	1278.8072	1206.6681	1066.3858	929.2981	864.5401 (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	42.4118	42.5867	42.7630	43.6671	43.8525	44.8038	44.8038	44.9990	44.4184	43.8525	43.4832	43.1201
alpha	3.8275	3.8391	3.8509	3.9111	3.9235	3.9869	3.9869	3.9999	3.9612	3.9235	3.8989	3.8747
util living area	0.9783	0.9555	0.9189	0.8374	0.7064	0.5300	0.3918	0.4312	0.6448	0.8691	0.9592	0.9822 (86)
MIT	19.7350	19.9726	20.2435	20.5642	20.7795	20.8892	20.9147	20.9114	20.8485	20.5642	20.1054	19.7070 (87)
Th 2	20.1258	20.1290	20.1323	20.1488	20.1521	20.1686	20.1686	20.1720	20.1620	20.1521	20.1455	20.1389 (88)
util rest of house	0.9743	0.9477	0.9049	0.8105	0.6619	0.4688	0.3203	0.3573	0.5835	0.8412	0.9508	0.9789 (89)
MIT 2	18.6338	18.9350	19.2745	19.6746	19.9203	20.0451	20.0653	20.0668	20.0038	19.6855	19.1183	18.6083 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.7978	19.0896	19.4189	19.8072	20.0483	20.1709	20.1919	20.1926	20.1296	19.8164	19.2654	18.7720 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7978	19.0896	19.4189	19.8072	20.0483	20.1709	20.1919	20.1926	20.1296	19.8164	19.2654	18.7720 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9663	0.9362	0.8912	0.7985	0.6561	0.4689	0.3223	0.3592	0.5809	0.8285	0.9398	0.9720 (94)
Useful gains	886.3014	1045.4279	1109.0787	1093.4929	945.3421	665.3564	438.5092	459.3830	701.0134	883.4877	873.3607	840.2971 (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	1884.2044	1836.5694	1665.2027	1376.7909	1049.3387	685.3607	441.8928	464.5681	748.2369	1158.4514	1542.1124	1862.7342 (97)
Space heating kWh	742.4398	531.6470	413.7563	203.9746	77.3734	0.0000	0.0000	0.0000	0.0000	204.5730	481.5012	760.6932 (98a)
Space heating requirement - total per year (kWh/year)												3415.9585
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	742.4398	531.6470	413.7563	203.9746	77.3734	0.0000	0.0000	0.0000	0.0000	204.5730	481.5012	760.6932 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3415.9585
Space heating per m2												24.9522 (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	742.4398	531.6470	413.7563	203.9746	77.3734	0.0000	0.0000	0.0000	0.0000	204.5730	481.5012	760.6932 (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)	836.0809	598.7016	465.9417	229.7011	87.1322	0.0000	0.0000	0.0000	0.0000	230.3750	542.2311	856.6365 (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	268.0026	236.5619	250.1676	217.1974	208.6767	186.0027	182.0850	190.4449	193.7868	218.5258	235.3465	264.7128 (64)
Efficiency of water heater (217)m	88.6401	88.6144	88.5730	88.4896	88.3615	88.2000	88.2000	88.2000	88.2000	88.4891	88.6021	88.6443 (217)
Fuel for water heating, kWh/month	302.3493	266.9565	282.4424	245.4497	236.1624	210.8875	206.4456	215.9240	219.7129	246.9522	265.6217	298.6236 (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	34.9137	31.5350	34.9137	33.7875	34.9137	33.7875	34.9137	34.9137	33.7875	34.9137	33.7875	34.9137 (231)
Lighting	33.3268	26.7360	24.0728	17.6368	13.6231	11.1302	12.4275	16.1537	20.9821	27.5296	31.0947	34.2531 (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)												

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(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												3846.8001	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.2000	
Water heating fuel used												2997.5279	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7980)													
mechanical ventilation fans (SFP = 0.7980)												325.0807	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												411.0807	(231)
Electricity for lighting (calculated in Appendix L)												268.9664	(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												7524.3751	(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	3846.8001	0.2100	807.8280	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2997.5279	0.2100	629.4808	(264)
Space and water heating			1437.3089	(265)
Pumps, fans and electric keep-hot	411.0807	0.1387	57.0220	(267)
Energy for lighting	268.9664	0.1443	38.8202	(268)
Total CO2, kg/year			1533.1510	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.2000	(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	3846.8001	1.1300	4346.8842	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2997.5279	1.1300	3387.2065	(278)
Space and water heating			7734.0906	(279)
Pumps, fans and electric keep-hot	411.0807	1.5128	621.8829	(281)
Energy for lighting	268.9664	1.5338	412.5496	(282)
Total Primary energy kWh/year			8768.5232	(286)
Dwelling Primary energy Rate (DPER)			64.0500	(287)

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

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	60.3400 (1b)	x 2.4000 (2b)	= 144.8160 (1b)	- (3b)
First floor	44.0500 (1c)	x 2.6100 (2c)	= 114.9705 (1c)	- (3c)
Second floor	32.5100 (1d)	x 2.2800 (2d)	= 74.1228 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	136.9000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 333.9093	(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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1198	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	

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Measured/design AP50													5.0000 (17)
Infiltration rate													0.3698 (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) = 0.2866 (21)

  

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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													
	0.3654	0.3582	0.3511	0.3152	0.3081	0.2723	0.2723	0.2651	0.2866	0.3081	0.3224	0.3367	(22b)
Effective ac	0.5668	0.5642	0.5616	0.5497	0.5475	0.5371	0.5371	0.5351	0.5411	0.5475	0.5520	0.5567	(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 Semi-glazed door			1.9000	1.0000	1.9000			(26a)
TER Opening Type (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
N RW			2.3100	1.5038	3.4737			(27a)
Ground Floor			60.3400	0.1300	7.8442			(28a)
External Wall	169.0400	22.3700	146.6700	0.1800	26.4006			(29a)
Dormer Walls	17.4900	2.5300	14.9600	0.1800	2.6928			(29a)
Dwarf Walls (0.72)	10.1500		10.1500	0.1800	1.8270			(29a)
Joisted Roof	16.2900		16.2900	0.1100	1.7919			(30)
Rafter Roof	29.3500	2.3100	27.0400	0.1100	2.9744			(30)
Rafter Eaves (0.72)	7.6200		7.6200	0.1100	0.8382			(30)
Flat Dormer Roof	12.0600		12.0600	0.1100	1.3266			(30)
Total net area of external elements Aum(A, m2)			322.3400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 77.4053			(33)

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

144.9473 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	14.5800	0.0500	0.7290	
E2 Other lintels (including other steel lintels)	2.3000	0.0500	0.1150	
E3 Sill	8.0900	0.0500	0.4045	
E3 Sill	2.3000	0.0500	0.1150	
E4 Jamb	22.6200	0.0500	1.1310	
E4 Jamb	4.4000	0.0500	0.2200	
E5 Ground floor (normal)	33.6200	0.1600	5.3792	
E6 Intermediate floor within a dwelling	27.3800	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	17.3600	0.0600	1.0416	
E24 Eaves (insulation at ceiling level - inverted)	15.4300	0.2400	3.7032	
E11 Eaves (insulation at rafter level)	10.2800	0.0400	0.4112	
E12 Gable (insulation at ceiling level)	4.3400	0.0600	0.2604	
E13 Gable (insulation at rafter level)	22.3600	0.0800	1.7888	
E16 Corner (normal)	23.6000	0.0900	2.1240	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	
R1 Head of roof window	2.1000	0.0800	0.1680	
R2 Sill of roof window	2.1000	0.0600	0.1260	
R3 Jamb of roof window	6.6000	0.0800	0.5280	
R6 Flat ceiling	16.4900	0.0600	0.9894	
R7 Flat ceiling (inverted)	7.7400	0.0400	0.3096	
R9 Roof to wall (flat ceiling)	10.0000	0.0400	0.4000	

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

19.5119 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 96.9172 (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	
	62.4512	62.1656	61.8856	60.5705	60.3244	59.1790	59.1790	58.9669	59.6202	60.3244	60.8222	61.3426	(38)
Heat transfer coeff													
	159.3684	159.0827	158.8028	157.4876	157.2416	156.0961	156.0961	155.8840	156.5373	157.2416	157.7393	158.2597	(39)
Average = Sum(39)m / 12 =													157.4865

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1641	1.1620	1.1600	1.1504	1.1486	1.1402	1.1402	1.1387	1.1434	1.1486	1.1522	1.1560	(40)
HLP (average)													1.1504
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy													2.9109 (42)
Hot water usage for mixer showers													
	73.0267	71.9292	70.3300	67.2703	65.0122	62.4941	61.0628	62.6499	64.3896	67.0933	70.2188	72.7469	(42a)
Hot water usage for baths													
	31.5271	31.0589	30.3995	29.1838	28.2735	27.2641	26.7188	27.3736	28.0865	29.1666	30.4073	31.4205	(42b)
Hot water usage for other uses													
	44.4409	42.8249	41.2088	39.5928	37.9768	36.3607	36.3607	37.9768	39.5928	41.2088	42.8249	44.4409	(42c)
Average daily hot water use (litres/day)													136.9596 (43)

  

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	148.9947	145.8130	141.9384	136.0469	131.2625	126.1189	124.1423	128.0002	132.0689	137.4687	143.4510	148.6083	(44)
Energy conte	235.9712	207.6357	218.1540	186.2413	176.7045	155.0779	150.1394	158.4910	162.8541	186.5438	204.3723	232.6847	(45)
Energy content (annual)													
										Total = Sum(45)m =			2274.8699
Distribution loss (46)m = 0.15 x (45)m													
	35.3957	31.1454	32.7231	27.9362	26.5057	23.2617	22.5209	23.7736	24.4281	27.9816	30.6558	34.9027	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	286.9301	253.6631	269.1129	235.5564	227.6634	204.3929	201.0983	209.4499	212.1692	237.5027	253.6874	283.6436	(62)
WWHRS	-33.3848	-29.5257	-30.9177	-25.6010	-23.8593	-20.4165	-19.1372	-20.3505	-21.1237	-24.9026	-28.2116	-32.7665	(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)

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Output from w/h	253.5453	224.1374	238.1953	209.9554	203.8041	183.9764	181.9610	189.0993	191.0455	212.6001	225.4758	250.8771 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2564.6728 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	91.2001	80.5457	85.2759	74.2540	71.4940	63.8922	62.6611	65.4380	66.4778	74.7655	80.2826	90.1074 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469	145.5469 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.5024	173.2705	156.5024	161.7191	156.5024	161.7191	156.5024	156.5024	161.7191	156.5024	161.7191	156.5024 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.8589	309.0328	301.0348	284.0079	262.5146	242.3139	228.8186	225.6447	233.6428	250.6696	272.1629	292.3636 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547	37.5547 (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)	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375	-116.4375 (71)
Water heating gains (Table 5)	122.5808	119.8597	114.6182	103.1306	96.0940	88.7391	84.2219	87.9543	92.3302	100.4913	111.5036	121.1121 (72)
Total internal gains	654.6062	671.8271	641.8194	618.5217	584.7751	559.4362	536.2069	536.7654	554.3562	577.3273	615.0497	639.6421 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	5.9000	10.6334	0.6300	0.7000	0.7700	19.1732 (74)						
South	16.0200	46.7521	0.6300	0.7000	0.7700	228.8944 (78)						
West	1.0800	19.6403	0.6300	0.7000	0.7700	6.4825 (80)						
North	2.3100	15.6897	0.6300	0.7000	1.0000	14.3849 (82)						
Solar gains	268.9351	451.1743	609.0365	757.2554	862.5378	865.8025	830.5365	748.4278	658.6948	495.4351	320.6168	231.2591 (83)
Total gains	923.5413	1123.0013	1250.8559	1375.7771	1447.3129	1425.2387	1366.7434	1285.1933	1213.0509	1072.7624	935.6664	870.9012 (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
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9800	0.9623	0.9349	0.8759	0.7734	0.6201	0.4764	0.5202	0.7234	0.8996	0.9655	0.9834 (86)
MIT	18.9485	19.2696	19.6748	20.1786	20.5976	20.8645	20.9579	20.9429	20.7621	20.2138	19.4893	18.8901 (87)
Th 2	19.9488	19.9505	19.9521	19.9599	19.9614	19.9681	19.9681	19.9694	19.9655	19.9614	19.9584	19.9553 (88)
util rest of house	0.9761	0.9549	0.9219	0.8505	0.7262	0.5427	0.3749	0.4178	0.6537	0.8736	0.9575	0.9800 (89)
MIT 2	17.5620	17.9681	18.4770	19.0998	19.5882	19.8708	19.9480	19.9400	19.7769	19.1563	18.2557	17.4920 (90)
Living area fraction	fLA = Living area / (4) = 0.1490 (91)											
MIT	17.7686	18.1621	18.6555	19.2605	19.7386	20.0189	20.0985	20.0894	19.9237	19.3139	18.4395	17.7003 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.7686	18.1621	18.6555	19.2605	19.7386	20.0189	20.0985	20.0894	19.9237	19.3139	18.4395	17.7003 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9640	0.9379	0.9012	0.8300	0.7149	0.5467	0.3883	0.4304	0.6506	0.8533	0.9413	0.9693 (94)
Useful gains	890.2762	1053.2439	1127.2977	1141.9232	1034.6302	779.2357	530.7029	553.0942	789.2067	915.4052	880.7572	844.1750 (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	2146.4660	2109.7660	1930.3320	1631.6576	1263.9996	845.8617	546.1018	575.1212	911.6246	1370.1863	1788.6914	2136.5560 (97)
Space heating kWh	934.6052	709.9828	597.4575	352.6087	170.6508	0.0000	0.0000	0.0000	0.0000	338.3572	653.7126	961.5315 (98a)
Space heating requirement - total per year (kWh/year)	4718.9064											
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	934.6052	709.9828	597.4575	352.6087	170.6508	0.0000	0.0000	0.0000	0.0000	338.3572	653.7126	961.5315 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4718.9064											
Space heating per m <sup>2</sup>												(98c) / (4) = 34.4697 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	934.6052	709.9828	597.4575	352.6087	170.6508	0.0000	0.0000	0.0000	0.0000	338.3572	653.7126	961.5315 (98)
Space heating efficiency (main heating system 1)												

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Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating efficiency (main heating system 2)	1011.4775	768.3797	646.5990	381.6112	184.6871	0.0000	0.0000	0.0000	0.0000	366.1874	707.4812	1040.6185	(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)
Water heating requirement	253.5453	224.1374	238.1953	209.9554	203.8041	183.9764	181.9610	189.0993	191.0455	212.6001	225.4758	250.8771	(64)
Efficiency of water heater (217)m	86.9137	86.6727	86.2665	85.4832	84.0034	80.3000	80.3000	80.3000	80.3000	85.3719	86.5235	80.3000	(216)
Fuel for water heating, kWh/month	291.7209	258.6020	276.1156	245.6101	242.6141	229.1113	226.6016	235.4911	237.9147	249.0283	260.5948	288.4554	(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	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.5181	26.0872	23.4887	17.2088	13.2926	10.8601	12.1259	15.7617	20.4729	26.8616	30.3401	33.4219	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-54.8912	-76.5996	-108.9710	-121.1689	-129.4492	-120.2942	-118.6925	-112.5694	-101.6909	-86.8329	-60.0200	-47.5398	(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	-33.4584	-70.0896	-138.8086	-207.8065	-274.1858	-275.3753	-272.2436	-230.8727	-169.6330	-100.1412	-44.6311	-26.4902	(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												5107.0415	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	(216)
Water heating fuel used												3041.8599	(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)												262.4397	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2982.4557	(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												5514.8854	(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	5107.0415	0.2100	1072.4787 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3041.8599	0.2100	638.7906 (264)
Space and water heating			1711.2693 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	262.4397	0.1443	37.8782 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1138.7197	0.1348	-153.5357
PV Unit electricity exported	-1843.7360	0.1260	-232.2784
Total			-385.8142 (269)
Total CO2, kg/year			1375.2625 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0500 (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	5107.0415	1.1300	5770.9569 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3041.8599	1.1300	3437.3017 (278)
Space and water heating			9208.2586 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	262.4397	1.5338	402.5388 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1138.7197	1.4983	-1706.1776
PV Unit electricity exported	-1843.7360	0.4624	-852.6274
Total			-2558.8050 (283)
Total Primary energy kWh/year			7182.0932 (286)
Target Primary Energy Rate (TPER)			52.4600 (287)