

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-577				Issued on Date	22/03/2023
Assessment Reference	Plot 577	Prop Type Ref	3-OP-SEMI			
Property	Plot 577, 3 Bed, K, WC, B					
SAP Rating	85 B	DER	16.07	TER	17.55	
Environmental	87 B	% DER<TER	8.45			
CO ₂ Emissions (t/year)	1.26	DFEE	44.11	TFEE	51.20	
General Requirements Compliance	Pass	% DFEE<TFEE	13.84			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.55 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.07 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North East: 4.12 m², No overhang
Windows facing South West: 7.82 m², No overhang
Windows facing North West: 1.54 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.035 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3459 (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	0.4410	0.4324	0.4237	0.3805	0.3719	0.3286	0.3286	0.3200	0.3459	0.3719	0.3892	0.4064 (22b)
Effective ac	0.5973	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
143.9569 (35)
6.7214 (36)
(33) + (36) = 60.4807 (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	47.8922	47.5894	47.2925	45.8983	45.6374	44.4230	44.4230	44.1982	44.8908	45.6374	46.1651	46.7168 (38)
Heat transfer coeff	108.3729	108.0700	107.7732	106.3789	106.1181	104.9037	104.9037	104.6788	105.3715	106.1181	106.6458	107.1975 (39)
Average = Sum(39)m / 12 =												106.3777 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1529	1.1497	1.1465	1.1317	1.1289	1.1160	1.1160	1.1136	1.1210	1.1289	1.1345	1.1404 (40)
HLP (average)												1.1317 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6766 (42)
97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

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Energy content (annual)												Total = Sum(45)m =	1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)	
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850	14.6803 (61)	
Total heat required for water heating calculated for each month													
	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (62)	
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 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (64)	
								Total per year (kWh/year) = Sum(64)m =					1710.1423 (64)
Heat gains from water heating, kWh/month													
	56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267 (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	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606	(72)
Total internal gains	412.0407	409.7128	394.6865	370.4715	345.7790	322.1788	307.0009	313.4298	326.0197	350.4580	378.4661	399.5727	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.1200	11.2829	0.4600	0.0000	0.7700		16.4652 (75)	
Southwest					4.4900	36.7938	0.4600	0.0000	0.7700		58.5154 (79)	
Northwest					1.5400	11.2829	0.4600	0.0000	0.7700		6.1545 (81)	
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700		43.3978 (79)	

Solar gains	124.5329	219.6390	320.4764	430.5365	512.7690	522.4911	498.1481	434.7458	358.2674	248.1287	150.5300	105.6888 (83)
Total gains	536.5736	629.3517	715.1630	801.0080	858.5481	844.6698	805.1490	748.1756	684.2872	598.5868	528.9961	505.2615 (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	34.6846	34.7818	34.8776	35.3348	35.4216	35.8317	35.8317	35.9086	35.6726	35.4216	35.2463	35.0649	
alpha	3.3123	3.3188	3.3252	3.3557	3.3614	3.3888	3.3888	3.3939	3.3782	3.3614	3.3498	3.3377	
util living area	0.9874	0.9779	0.9583	0.9120	0.8212	0.6769	0.5326	0.5835	0.7944	0.9371	0.9794	0.9896	(86)
MIT	19.0775	19.3096	19.6799	20.1590	20.5739	20.8488	20.9503	20.9318	20.7220	20.1795	19.5444	19.0394	(87)
Th 2	19.9579	19.9605	19.9630	19.9750	19.9773	19.9878	19.9878	19.9897	19.9837	19.9773	19.9727	19.9680	(88)
util rest of house	0.9848	0.9734	0.9494	0.8922	0.7794	0.6007	0.4255	0.4769	0.7321	0.9190	0.9744	0.9875	(89)
MIT 2	17.3874	17.7257	18.2618	18.9495	19.5141	19.8592	19.9594	19.9475	19.7197	18.9919	18.0771	17.3382	(90)
Living area fraction													
MIT	17.6931	18.0121	18.5183	19.1682	19.7057	20.0382	20.1386	20.1255	19.9010	19.2067	18.3425	17.6459	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5431	17.8621	18.3683	19.0182	19.5557	19.8882	19.9886	19.9755	19.7510	19.0567	18.1925	17.4959	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9756	0.9600	0.9306	0.8689	0.7592	0.5924	0.4256	0.4752	0.7153	0.8970	0.9615	0.9795	(94)
Useful gains	523.4728	604.2027	665.5295	695.9842	651.8455	500.3495	342.6905	355.5633	489.4743	536.9498	508.6473	494.9092	(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	1435.1900	1400.8172	1279.0805	1076.3680	833.6351	554.7531	355.4777	374.2809	595.4500	897.4062	1182.9664	1425.2828	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	678.3176	535.3249	456.4819	273.8764	135.2515	0.0000	0.0000	0.0000	0.0000	268.1795	485.5098	692.1980	(98)
Space heating												3525.1396	(98)
Space heating per m2												(98) / (4) =	37.5015 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3895.1818 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.3176	535.3249	456.4819	273.8764	135.2515	0.0000	0.0000	0.0000	0.0000	268.1795	485.5098	692.1980 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	749.5222	591.5192	504.3999	302.6258	149.4492	0.0000	0.0000	0.0000	0.0000	296.3310	536.4749	764.8596 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (64)
Efficiency of water heater (217)m	89.8272	89.7695	89.6527	89.3936	88.8729	87.3000	87.3000	87.3000	87.3000	89.3511	89.6988	87.3000 (216)
Fuel for water heating, kWh/month	193.9096	170.1569	176.8917	156.1744	151.8578	135.0958	126.8674	143.1948	144.2002	162.1772	174.3814	188.2360 (219)
Water heating fuel used												1923.1431 (219)
Annual totals kWh/year												
Space heating fuel - main system												3895.1818 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												413.7723 (232)
Total delivered energy for all uses												6307.0973 (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	3895.1818	0.2160	841.3593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1923.1431	0.2160	415.3989 (264)
Space and water heating			1256.7582 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total CO2, kg/year			1510.4310 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0700 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.0700 ZC1
Total Floor Area	TFA	94.0000
Assumed number of occupants	N	2.6766
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.5235 ZC2
CO2 emissions from cooking, equation (L16)		1.9493 ZC3
Total CO2 emissions		33.5429 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		33.5429 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3735 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3455 (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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3195	0.3455	0.3714	0.3886	0.4059 (22b)
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			13.4800	1.3258	17.8712		(27)
GF B&B J150 P/A=0.40			47.0000	0.1300	6.1100		(28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.1800	15.2442		(29a)
Plane Ceiling	47.0000		47.0000	0.1300	6.1100		(30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.4654		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0340 (36)
Total fabric heat loss						(33) + (36) =	57.4994 (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	47.8714	47.5693	47.2733	45.8828	45.6226	44.4115	44.4115	44.1872	44.8780	45.6226	46.1489	46.6991 (38)
Heat transfer coeff	105.3708	105.0687	104.7727	103.3822	103.1220	101.9109	101.9109	101.6866	102.3774	103.1220	103.6483	104.1985 (39)
Average = Sum(39)m / 12 =												103.3809 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1210	1.1178	1.1146	1.0998	1.0970	1.0842	1.0842	1.0818	1.0891	1.0970	1.1026	1.1085 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Energy content (annual)										Total = Sum(45)m =		1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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												

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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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.8187	47.2508	46.8329	43.3936	44.8400	46.8329	47.2508	50.8187	49.3151	50.9589 (61)
Solar input	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (64)
	65.7696	57.8871	60.5649	53.5384	51.7451	45.3971	43.2245	48.4453	48.9886	56.0296	59.6213	64.0963 (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	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	88.4000	86.1415	81.4045	74.3589	69.5498	63.0516	58.0975	65.1147	68.0397	75.3085	82.8073	86.1510	(72)
Total internal gains	424.2260	421.9032	406.8408	381.9756	356.6272	332.3736	317.2055	324.2871	337.5375	362.6260	390.6641	411.7631	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				4.1200	11.2829	0.6300	0.7000	0.7700	14.2066	(75)			
Southwest				7.8200	36.7938	0.6300	0.7000	0.7700	87.9333	(79)			
Northwest				1.5400	11.2829	0.6300	0.7000	0.7700	5.3102	(81)			
Solar gains	107.4502	189.5102	276.5154	371.4781	442.4305	450.8189	429.8152	375.1100	309.1225	214.0919	129.8812	91.1911	(83)
Total gains	531.6763	611.4134	683.3562	753.4537	799.0577	783.1925	747.0207	699.3971	646.6600	576.7180	520.5453	502.9542	(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	61.9506	62.1286	62.3042	63.1422	63.3015	64.0538	64.0538	64.1951	63.7619	63.3015	62.9801	62.6475	
alpha	5.1300	5.1419	5.1536	5.2095	5.2201	5.2703	5.2703	5.2797	5.2508	5.2201	5.1987	5.1765	
util living area	0.9985	0.9966	0.9910	0.9704	0.9052	0.7550	0.5833	0.6400	0.8747	0.9815	0.9968	0.9989	(86)
MIT	19.7658	19.9123	20.1533	20.4759	20.7622	20.9384	20.9872	20.9796	20.8578	20.4891	20.0710	19.7435	(87)
Th 2	19.9837	19.9864	19.9889	20.0010	20.0032	20.0138	20.0138	20.0157	20.0097	20.0032	19.9987	19.9939	(88)
util rest of house	0.9980	0.9954	0.9876	0.9586	0.8668	0.6675	0.4612	0.5172	0.8108	0.9720	0.9955	0.9985	(89)
MIT 2	18.3331	18.5490	18.9015	19.3728	19.7614	19.9709	20.0088	20.0069	19.8903	19.3987	18.7902	18.3078	(90)
Living area fraction	18.5922	18.7955	19.1278	19.5723	19.9424	20.1459	20.1858	20.1828	20.0653	19.5959	19.0218	18.5675	(91)
MIT	18.5922	18.7955	19.1278	19.5723	19.9424	20.1459	20.1858	20.1828	20.0653	19.5959	19.0218	18.5675	(92)
Temperature adjustment	18.5922	18.7955	19.1278	19.5723	19.9424	20.1459	20.1858	20.1828	20.0653	19.5959	19.0218	18.5675	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9934	0.9837	0.9520	0.8640	0.6803	0.4833	0.5392	0.8151	0.9666	0.9935	0.9977	(94)
Useful gains	530.0258	607.3486	672.1920	717.3106	690.3757	532.8073	361.0701	377.1172	527.0663	557.4690	517.1633	501.7737	(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	1505.9838	1459.9856	1323.0535	1103.3226	849.9760	565.1857	365.4296	384.6641	610.7091	927.6789	1235.6731	1497.0686	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	726.1127	572.9721	484.2410	277.9286	118.7426	0.0000	0.0000	0.0000	0.0000	275.4362	517.3271	740.4994	(98)
Space heating												3713.2597	(98)
Space heating per m2												39.5028	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3975.6528 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	726.1127	572.9721	484.2410	277.9286	118.7426	0.0000	0.0000	0.0000	0.0000	275.4362	517.3271	740.4994 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	777.4226	613.4605	518.4593	297.5681	127.1334	0.0000	0.0000	0.0000	0.0000	294.8995	553.8834	792.8259 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (64)
Efficiency of water heater (217)m	87.9153	87.7020	87.2522	86.2422	84.2062	80.3000	80.3000	80.3000	80.3000	86.1037	87.4286	80.3000 (216)
Fuel for water heating, kWh/month	239.3750	211.5311	223.2143	200.2984	198.6130	183.4366	175.7462	195.9159	198.0796	210.3500	219.0910	233.4353 (219)
Water heating fuel used												2489.0864 (219)
Annual totals kWh/year												
Space heating fuel - main system												3975.6528 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												413.7723 (232)
Total delivered energy for all uses												6953.5115 (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	3975.6528	0.2160	858.7410 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.0864	0.2160	537.6427 (264)
Space and water heating			1396.3837 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total CO2, kg/m2/year			1650.0565 (272)
Emissions per m2 for space and water heating			14.8551 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2846 (272b)
Emissions per m2 for pumps and fans			0.4141 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8551 * 1.00) + 2.2846 + 0.4141, rounded to 2 d.p.			17.5500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3459 (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	0.4410	0.4324	0.4237	0.3805	0.3719	0.3286	0.3286	0.3200	0.3459	0.3719	0.3892	0.4064 (22b)
Effective ac	0.5973	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
143.9569 (35)
6.7214 (36)
(33) + (36) = 60.4807 (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	47.8922	47.5894	47.2925	45.8983	45.6374	44.4230	44.4230	44.1982	44.8908	45.6374	46.1651	46.7168 (38)
Heat transfer coeff	108.3729	108.0700	107.7732	106.3789	106.1181	104.9037	104.9037	104.6788	105.3715	106.1181	106.6458	107.1975 (39)
Average = Sum(39)m / 12 =												106.3777 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1529	1.1497	1.1465	1.1317	1.1289	1.1160	1.1160	1.1136	1.1210	1.1289	1.1345	1.1404 (40)
HLP (average)												1.1317 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.6766 (42)
97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8913	29.6415	30.5874	26.6668	25.5875	22.0800	20.4604	23.4786	23.7590	27.6888	30.2245	32.8219 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	45.5528	44.1094	41.1121	37.0373	34.3917	30.6667	27.5005	31.5573	32.9986	37.2162	41.9785	44.1154	(72)
Total internal gains	378.3788	376.8711	363.5484	341.6539	318.4691	296.9887	283.6086	287.7297	299.4964	321.5337	346.8353	366.7276	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.1200	11.2829	0.4600	0.0000	0.7700	16.4652 (75)			
Southwest				4.4900	36.7938	0.4600	0.0000	0.7700	58.5154 (79)			
Northwest				1.5400	11.2829	0.4600	0.0000	0.7700	6.1545 (81)			
Southwest				3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)			
Solar gains	124.5329	219.6390	320.4764	430.5365	512.7690	522.4911	498.1481	434.7458	358.2674	248.1287	150.5300	105.6888 (83)
Total gains	502.9117	596.5100	684.0248	772.1904	831.2381	819.4798	781.7567	722.4755	657.7639	569.6624	497.3652	472.4164 (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	34.6846	34.7818	34.8776	35.3348	35.4216	35.8317	35.8317	35.9086	35.6726	35.4216	35.2463	35.0649	
alpha	3.3123	3.3188	3.3252	3.3557	3.3614	3.3888	3.3888	3.3939	3.3782	3.3614	3.3498	3.3377	
util living area	0.9896	0.9810	0.9629	0.9193	0.8319	0.6900	0.5454	0.5991	0.8086	0.9445	0.9827	0.9915	(86)
MIT	19.0292	19.2641	19.6398	20.1278	20.5534	20.8393	20.9466	20.9260	20.7042	20.1449	19.5001	18.9917	(87)
Th 2	19.9579	19.9605	19.9630	19.9750	19.9773	19.9878	19.9878	19.9897	19.9837	19.9773	19.9727	19.9680	(88)
util rest of house	0.9874	0.9771	0.9549	0.9008	0.7915	0.6141	0.4369	0.4913	0.7483	0.9281	0.9785	0.9897	(89)
MIT 2	18.1551	18.3899	18.7627	19.2460	19.6440	19.8938	19.9668	19.9582	19.7901	19.2722	18.6350	18.1252	(90)
Living area fraction	18.3131	18.5480	18.9213	19.4054	19.8085	20.0648	20.1440	20.1332	19.9554	19.4300	18.7915	18.2819	(92)
MIT	18.3131	18.5480	18.9213	19.4054	19.8085	20.0648	20.1440	20.1332	19.9554	19.4300	18.7915	18.2819	(93)
Temperature adjustment	18.3131	18.5480	18.9213	19.4054	19.8085	20.0648	20.1440	20.1332	19.9554	19.4300	18.7915	18.2819	(93)
adjusted MIT	18.3131	18.5480	18.9213	19.4054	19.8085	20.0648	20.1440	20.1332	19.9554	19.4300	18.7915	18.2819	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	494.1872	578.5403	646.0722	685.9257	651.5616	508.4473	355.4445	366.8947	490.8972	522.3401	483.3482	465.6523	(94)
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	1518.6443	1474.9388	1338.6840	1117.5580	860.4546	573.2796	371.7781	390.7886	616.9944	937.0236	1246.8471	1509.5456	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	762.1961	602.3798	515.3032	310.7753	155.4164	0.0000	0.0000	0.0000	0.0000	308.5245	549.7192	776.6566	(98)
Space heating													
Space heating per m2	(98) / (4) = 42.3508 (99)												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	986.0950	776.2876	795.5592	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7992	0.8626	0.8344	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	788.1028	669.6374	663.7830	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1060.0280	1013.8205	946.5058	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	195.7862	256.0722	210.3458	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			662.2042 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	48.9465	64.0181	52.5864	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												165.5510 (107)
Energy for space heating												1.7612 (108)
Energy for space cooling												42.3508 (99)
Total												1.7612 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.1119 (109)
												44.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3735 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3455 (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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3195	0.3455	0.3714	0.3886	0.4059 (22b)
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			13.4800	1.3258	17.8712		(27)
GF B&B J150 P/A=0.40			47.0000	0.1300	6.1100		(28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.1800	15.2442		(29a)
Plane Ceiling	47.0000		47.0000	0.1300	6.1100		(30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.4654		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0340 (36)
Total fabric heat loss						(33) + (36) =	57.4994 (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	47.8714	47.5693	47.2733	45.8828	45.6226	44.4115	44.4115	44.1872	44.8780	45.6226	46.1489	46.6991 (38)
Heat transfer coeff	105.3708	105.0687	104.7727	103.3822	103.1220	101.9109	101.9109	101.6866	102.3774	103.1220	103.6483	104.1985 (39)
Average = Sum(39)m / 12 =												103.3809 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1210	1.1178	1.1146	1.0998	1.0970	1.0842	1.0842	1.0818	1.0891	1.0970	1.1026	1.1085 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Energy content (annual)										Total = Sum(45)m =		1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.8913	29.6415	30.5874	26.6668	25.5875	22.0800	20.4604	23.4786	23.7590	27.6888	30.2245	32.8219 (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	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4295	20.8099	16.9237	12.8124	9.5774	8.0856	8.7368	11.3564	15.2426	19.3540	22.5889	24.0807 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831 (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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644 (71)
Water heating gains (Table 5)	45.5528	44.1094	41.1121	37.0373	34.3917	30.6667	27.5005	31.5573	32.9986	37.2162	41.9785	44.1154 (72)
Total internal gains	378.3788	376.8711	363.5484	341.6539	318.4691	296.9887	283.6086	287.7297	299.4964	321.5337	346.8353	366.7276 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					4.1200	11.2829	0.6300	0.7000			0.7700			14.2066 (75)
Southwest					7.8200	36.7938	0.6300	0.7000			0.7700			87.9333 (79)
Northwest					1.5400	11.2829	0.6300	0.7000			0.7700			5.3102 (81)
Solar gains	107.4502	189.5102	276.5154	371.4781	442.4305	450.8189	429.8152	375.1100	309.1225	214.0919	129.8812	91.1911	(83)	
Total gains	485.8290	566.3813	640.0638	713.1320	760.8996	747.8076	713.4238	662.8397	608.6189	535.6256	476.7165	457.9187	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	61.9506	62.1286	62.3042	63.1422	63.3015	64.0538	64.0538	64.1951	63.7619	63.3015	62.9801	62.6475
alpha	5.1300	5.1419	5.1536	5.2095	5.2201	5.2703	5.2703	5.2797	5.2508	5.2201	5.1987	5.1765
util living area	0.9990	0.9976	0.9932	0.9763	0.9191	0.7780	0.6072	0.6686	0.8955	0.9865	0.9979	0.9993 (86)
MIT	19.7200	19.8678	20.1116	20.4407	20.7380	20.9288	20.9846	20.9751	20.8370	20.4511	20.0275	19.6984 (87)
Th 2	19.9837	19.9864	19.9889	20.0010	20.0032	20.0138	20.0138	20.0157	20.0097	20.0032	19.9987	19.9939 (88)
util rest of house	0.9987	0.9968	0.9907	0.9665	0.8844	0.6920	0.4819	0.5434	0.8375	0.9793	0.9970	0.9990 (89)
MIT 2	18.8112	18.9607	19.2054	19.5388	19.8183	19.9792	20.0097	20.0082	19.9135	19.5542	19.1303	18.7977 (90)
Living area fraction									fLA = Living area / (4) =			0.1809 (91)
MIT	18.9755	19.1247	19.3693	19.7019	19.9847	20.1509	20.1860	20.1831	20.0805	19.7164	19.2926	18.9606 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9755	19.1247	19.3693	19.7019	19.9847	20.1509	20.1860	20.1831	20.0805	19.7164	19.2926	18.9606 (93)

8. Space heating requirement

Utilisation	0.9982	0.9958	0.9886	0.9628	0.8836	0.7053	0.5048	0.5661	0.8425	0.9765	0.9961	0.9987 (94)
Useful gains	484.9510	563.9797	632.7612	686.5760	672.3593	527.3947	360.1221	375.2478	512.7727	523.0198	474.8435	457.3108 (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	1546.3727	1494.5753	1348.3506	1116.7220	854.3302	565.7001	365.4494	384.6857	612.2651	940.0989	1263.7378	1538.0315 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	789.6977	625.3602	532.3985	309.7051	135.3863	0.0000	0.0000	0.0000	0.0000	310.3069	568.0038	804.0562 (98)
Space heating												4074.9148 (98)
Space heating per m2										(98) / (4) =		43.3502 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	957.9624	754.1406	772.8182	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8484	0.9155	0.8887	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	812.6951	690.4309	686.8397	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	976.2554	933.9508	876.8016	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	117.7634	181.1788	141.3317	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												440.2739 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.4409	45.2947	35.3329	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												110.0685 (107)
Space cooling per m2												1.1709 (108)
Energy for space heating												43.3502 (99)
Energy for space cooling												1.1709 (108)
Total												44.5211 (109)
Target Fabric Energy Efficiency (TFEE)												51.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3459 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3632	0.3459	0.3459	0.3200	0.3200	0.2854	0.2940	0.2767	0.2854	0.3027	0.3027	0.3286 (22b)
	0.5660	0.5598	0.5598	0.5512	0.5512	0.5407	0.5432	0.5383	0.5407	0.5458	0.5458	0.5540 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
Total fabric heat loss (33) + (36) = 60.4807 (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	45.3825	44.8908	44.8908	44.1982	44.1982	43.3586	43.5595	43.1637	43.3586	43.7664	43.7664	44.4230 (38)
Heat transfer coeff	105.8632	105.3715	105.3715	104.6788	104.6788	103.8393	104.0402	103.6444	103.8393	104.2471	104.2471	104.9037 (39)
Average = Sum(39)m / 12 =												104.5604 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1262	1.1210	1.1210	1.1136	1.1136	1.1047	1.1068	1.1026	1.1047	1.1090	1.1090	1.1160 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)
Average daily hot water use (litres/day) 97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850	14.6803 (61)
Total heat required for water heating calculated for each month	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (62)
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 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (64)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 1710.1423 (64)
Heat gains from water heating, kWh/month	56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267 (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	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606	(72)
Total internal gains	612.5903	607.5915	583.5645	546.4305	508.3626	474.5143	454.9617	464.0615	485.6522	523.0094	564.3930	595.7476	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.1200	12.9236		0.4600		0.0000		0.7700		18.8594 (75)
Southwest				4.4900	40.4699		0.4600		0.0000		0.7700		64.3617 (79)
Northwest				1.5400	12.9236		0.4600		0.0000		0.7700		7.0494 (81)
Southwest				3.3300	40.4699		0.4600		0.0000		0.7700		47.7337 (79)
Solar gains	138.0041	219.4739	317.7435	442.4100	515.2783	562.6201	530.3284	471.9901	385.9102	265.1170	170.9819	115.9424	(83)
Total gains	750.5944	827.0655	901.3080	988.8405	1023.6409	1037.1344	985.2901	936.0516	871.5624	788.1264	735.3748	711.6900	(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	35.5069	35.6726	35.6726	35.9086	35.9086	36.1990	36.1291	36.2670	36.1990	36.0574	36.0574	35.8317
alpha	3.3671	3.3782	3.3782	3.3939	3.3939	3.4133	3.4086	3.4178	3.4133	3.4038	3.4038	3.3888
util living area	0.9624	0.9469	0.9108	0.8303	0.6896	0.4759	0.3224	0.3477	0.6158	0.8488	0.9388	0.9672 (86)
MIT	19.5462	19.7279	20.0725	20.4824	20.8004	20.9610	20.9926	20.9905	20.9003	20.5273	19.9892	19.5137 (87)
Th 2	19.9795	19.9837	19.9837	19.9897	19.9897	19.9970	19.9953	19.9987	19.9970	19.9935	19.9935	19.9878 (88)
util rest of house	0.9551	0.9368	0.8934	0.7972	0.6302	0.3895	0.2202	0.2420	0.5319	0.8115	0.9251	0.9608 (89)
MIT 2	18.0775	18.3397	18.8281	19.3939	19.7972	19.9722	19.9931	19.9956	19.9200	19.4693	18.7244	18.0367 (90)
Living area fraction	18.3431	18.5908	19.0532	19.5908	19.9787	20.1510	20.1738	20.1756	20.0973	19.6607	18.9532	18.3038 (91)
MIT	18.3431	18.5908	19.0532	19.5908	19.9787	20.1510	20.1738	20.1756	20.0973	19.6607	18.9532	18.3038 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1931	18.4408	18.9032	19.4408	19.8287	20.0010	20.0238	20.0256	19.9473	19.5107	18.8032	18.1538 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9376	0.9166	0.8703	0.7762	0.6198	0.3898	0.2232	0.2449	0.5274	0.7901	0.9040	0.9446	(94)
Ext temp.	703.7486	758.1163	784.4102	767.5738	634.4859	404.2988	219.9127	229.2143	459.6458	622.7061	664.7516	672.2563	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1386.0753	1353.0500	1212.1070	998.7197	714.8158	415.4648	220.9637	230.6661	492.9551	824.6622	1126.1975	1369.3893	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
RHI space heating demand	507.6510	399.7955	318.2065	166.4250	59.7654	0.0000	0.0000	0.0000	0.0000	150.2553	332.2410	518.6669	(98)
												2453.0067	(98)
												2453	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3459 (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												
Effective ac	0.4410	0.4324	0.4237	0.3805	0.3719	0.3286	0.3286	0.3200	0.3459	0.3719	0.3892	0.4064 (22b)
	0.5973	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7214 (36)
Total fabric heat loss							(33) + (36) = 60.4807 (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	47.8922	47.5894	47.2925	45.8983	45.6374	44.4230	44.4230	44.1982	44.8908	45.6374	46.1651	46.7168 (38)
Heat transfer coeff	108.3729	108.0700	107.7732	106.3789	106.1181	104.9037	104.9037	104.6788	105.3715	106.1181	106.6458	107.1975 (39)
Average = Sum(39)m / 12 =												106.3777 (39)
HLP	1.1529	1.1497	1.1465	1.1317	1.1289	1.1160	1.1160	1.1136	1.1210	1.1289	1.1345	1.1404 (40)
HLP (average)												1.1317 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684	(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)
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850	14.6803 (61)
Total heat required for water heating calculated for each month												
174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362	(64)
Heat gains from water heating, kWh/month												
56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267	(65)
Total per year (kWh/year) = Sum(64)m =												1710.1423 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606	(72)
Total internal gains	612.5903	607.5915	583.5645	546.4305	508.3626	474.5143	454.9617	464.0615	485.6522	523.0094	564.3930	595.7476	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.1200		11.2829		0.4600		0.0000		0.7700		16.4652 (75)
Southwest			4.4900		36.7938		0.4600		0.0000		0.7700		58.5154 (79)
Northwest			1.5400		11.2829		0.4600		0.0000		0.7700		6.1545 (81)
Southwest			3.3300		36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	124.5329	219.6390	320.4764	430.5365	512.7690	522.4911	498.1481	434.7458	358.2674	248.1287	150.5300	105.6888	(83)
Total gains	737.1232	827.2305	904.0409	976.9670	1021.1316	997.0053	953.1099	898.8073	843.9196	771.1381	714.9230	701.4364	(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	34.6846	34.7818	34.8776	35.3348	35.4216	35.8317	35.8317	35.9086	35.6726	35.4216	35.2463	35.0649
alpha	3.3123	3.3188	3.3252	3.3557	3.3614	3.3888	3.3888	3.3939	3.3782	3.3614	3.3498	3.3377
util living area	0.9691	0.9537	0.9246	0.8634	0.7574	0.6035	0.4620	0.5038	0.7111	0.8858	0.9530	0.9733 (86)
MIT	19.3546	19.5703	19.9065	20.3297	20.6772	20.8942	20.9677	20.9564	20.8076	20.3642	19.7908	19.3147 (87)
Th 2	19.9579	19.9605	19.9630	19.9750	19.9773	19.9878	19.9878	19.9897	19.9837	19.9773	19.9727	19.9680 (88)
util rest of house	0.9633	0.9450	0.9102	0.8366	0.7096	0.5278	0.3645	0.4052	0.6418	0.8577	0.9428	0.9682 (89)
MIT 2	17.7870	18.0981	18.5790	19.1767	19.6369	19.9011	19.9701	19.9640	19.8098	19.2383	18.4277	17.7360 (90)
Living area fraction	fLA = Living area / (4) =											0.1809 (91)
MIT	18.0705	18.3644	18.8190	19.3852	19.8250	20.0807	20.1505	20.1435	19.9903	19.4419	18.6742	18.0215 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9205	18.2144	18.6690	19.2352	19.6750	19.9307	20.0005	19.9935	19.8403	19.2919	18.5242	17.8715 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9472	0.9255	0.8873	0.8136	0.6938	0.5232	0.3658	0.4056	0.6308	0.8343	0.9232	0.9535	(94)	
Useful gains	698.1779	765.5735	802.1440	794.8986	708.4540	521.6367	348.6289	364.5288	532.3800	643.3815	659.9814	668.8383	(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	1476.0905	1438.8830	1311.4956	1099.4513	846.2945	559.2137	356.7236	376.1585	604.8631	922.3712	1218.3443	1465.5537	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	578.7670	452.4640	378.9576	219.2779	102.5533	0.0000	0.0000	0.0000	0.0000	207.5683	402.0213	592.7562	(98)	
Space heating												2934.3657	(98)	
Space heating per m2												(98) / (4) =	31.2167	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3242.3931 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	578.7670	452.4640	378.9576	219.2779	102.5533	0.0000	0.0000	0.0000	0.0000	207.5683	402.0213	592.7562 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	639.5215	499.9603	418.7377	242.2961	113.3185	0.0000	0.0000	0.0000	0.0000	229.3572	444.2225	654.9793 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (64)
Efficiency of water heater (217)m	89.7390	89.6704	89.5318	89.2277	88.6535	87.3000	87.3000	87.3000	87.3000	89.1565	89.5803	87.3000 (216)
Fuel for water heating, kWh/month	194.1002	170.3449	177.1306	156.4648	152.2336	135.0958	126.8674	143.1948	144.2002	162.5313	174.6122	188.4116 (219)
Water heating fuel used												1925.1873 (219)
Annual totals kWh/year												
Space heating fuel - main system												3242.3931 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												413.7723 (232)
Total delivered energy for all uses												5656.3527 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3242.3931	3.4800	112.8353 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1925.1873	3.4800	66.9965 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	413.7723	13.1900	54.5766 (250)
Additional standing charges			120.0000 (251)
Total energy cost			364.3009 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1008 (257)
SAP value		84.6443
SAP rating (Section 12)		85 (258)
SAP band		B

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	3242.3931	0.2160	700.3569 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1925.1873	0.2160	415.8405 (264)
Space and water heating			1116.1974 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total kg/year			1369.8702 (272)
CO2 emissions per m2			14.5700 (273)
EI value			86.7941
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8871 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8871 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 242.9900 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3459 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3632	0.3459	0.3459	0.3200	0.3200	0.2854	0.2940	0.2767	0.2854	0.3027	0.3027	0.3286 (22b)
Effective ac	0.5660	0.5598	0.5598	0.5512	0.5512	0.5407	0.5432	0.5383	0.5407	0.5458	0.5458	0.5540 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
Total fabric heat loss (33) + (36) = 60.4807 (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	45.3825	44.8908	44.8908	44.1982	44.1982	43.3586	43.5595	43.1637	43.3586	43.7664	43.7664	44.4230 (38)
Heat transfer coeff	105.8632	105.3715	105.3715	104.6788	104.6788	103.8393	104.0402	103.6444	103.8393	104.2471	104.2471	104.9037 (39)
Average = Sum(39)m / 12 =												104.5604 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1262	1.1210	1.1210	1.1136	1.1136	1.1047	1.1068	1.1026	1.1047	1.1090	1.1090	1.1160 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6766 (42)
Average daily hot water use (litres/day) 97.7695 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850 (61)
Total heat required for water heating calculated for each month											
174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (64)
Heat gains from water heating, kWh/month											
56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267 (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	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606	(72)
Total internal gains	612.5903	607.5915	583.5645	546.4305	508.3626	474.5143	454.9617	464.0615	485.6522	523.0094	564.3930	595.7476	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.1200		12.9236		0.4600		0.0000		0.7700		18.8594 (75)
Southwest			4.4900		40.4699		0.4600		0.0000		0.7700		64.3617 (79)
Northwest			1.5400		12.9236		0.4600		0.0000		0.7700		7.0494 (81)
Southwest			3.3300		40.4699		0.4600		0.0000		0.7700		47.7337 (79)
Solar gains	138.0041	219.4739	317.7435	442.4100	515.2783	562.6201	530.3284	471.9901	385.9102	265.1170	170.9819	115.9424	(83)
Total gains	750.5944	827.0655	901.3080	988.8405	1023.6409	1037.1344	985.2901	936.0516	871.5624	788.1264	735.3748	711.6900	(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	35.5069	35.6726	35.6726	35.9086	35.9086	36.1990	36.1291	36.2670	36.1990	36.0574	36.0574	35.8317
alpha	3.3671	3.3782	3.3782	3.3939	3.3939	3.4133	3.4086	3.4178	3.4133	3.4038	3.4038	3.3888
util living area	0.9624	0.9469	0.9108	0.8303	0.6896	0.4759	0.3224	0.3477	0.6158	0.8488	0.9388	0.9672 (86)
MIT	19.5462	19.7279	20.0725	20.4824	20.8004	20.9610	20.9926	20.9905	20.9003	20.5273	19.9892	19.5137 (87)
Th 2	19.9795	19.9837	19.9837	19.9897	19.9897	19.9970	19.9953	19.9987	19.9970	19.9935	19.9935	19.9878 (88)
util rest of house	0.9551	0.9368	0.8934	0.7972	0.6302	0.3895	0.2202	0.2420	0.5319	0.8115	0.9251	0.9608 (89)
MIT 2	18.0775	18.3397	18.8281	19.3939	19.7972	19.9722	19.9931	19.9956	19.9200	19.4693	18.7244	18.0367 (90)
Living area fraction	18.3431	18.5908	19.0532	19.5908	19.9787	20.1510	20.1738	20.1756	20.0973	19.6607	18.9532	18.3038 (91)
MIT	18.3431	18.5908	19.0532	19.5908	19.9787	20.1510	20.1738	20.1756	20.0973	19.6607	18.9532	18.3038 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1931	18.4408	18.9032	19.4408	19.8287	20.0010	20.0238	20.0256	19.9473	19.5107	18.8032	18.1538 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9376	0.9166	0.8703	0.7762	0.6198	0.3898	0.2232	0.2449	0.5274	0.7901	0.9040	0.9446	(94)	
Useful gains	703.7486	758.1163	784.4102	767.5738	634.4859	404.2988	219.9127	229.2143	459.6458	622.7061	664.7516	672.2563	(95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)	
Heat loss rate W	1386.0753	1353.0500	1212.1070	998.7197	714.8158	415.4648	220.9637	230.6661	492.9551	824.6622	1126.1975	1369.3893	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	507.6510	399.7955	318.2065	166.4250	59.7654	0.0000	0.0000	0.0000	0.0000	150.2553	332.2410	518.6669	(98)	
Space heating												2453.0067	(98)	
Space heating per m2												(98) / (4) =	26.0958	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2710.5046 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	507.6510	399.7955	318.2065	166.4250	59.7654	0.0000	0.0000	0.0000	0.0000	150.2553	332.2410	518.6669	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	560.9404	441.7630	351.6094	183.8951	66.0392	0.0000	0.0000	0.0000	0.0000	166.0279	367.1172	573.1126	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362	(64)
Efficiency of water heater (217)m	89.6604	89.5921	89.4099	89.0116	88.2578	87.3000	87.3000	87.3000	87.3000	88.9002	89.4505	87.3000	(216)
Fuel for water heating, kWh/month	194.2704	170.4938	177.3720	156.8447	152.9161	135.0958	126.8674	143.1948	144.2002	162.9998	174.8656	188.5754	(219)
Water heating fuel used												1927.6960	(219)
Annual totals kWh/year													
Space heating fuel - main system												2710.5046	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												413.7723	(232)
Total delivered energy for all uses												5126.9729	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2710.5046	9.7400	264.0031 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1927.6960	9.7400	187.7576 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	413.7723	36.8500	152.4751 (250)
Additional standing charges			104.0000 (251)
Total energy cost			735.8733 (255)

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	2710.5046	0.2160	585.4690 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1927.6960	0.2160	416.3823 (264)
Space and water heating			1001.8513 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total kg/year			1255.5242 (272)

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	2710.5046	1.2200	3306.8156 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1927.6960	1.2200	2351.7891 (264)
Space and water heating			5658.6047 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	413.7723	3.0700	1270.2811 (268)
Primary energy kWh/year			7159.1358 (272)
Primary energy kWh/m2/year			76.1610 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 78	-188 kg (15.0%)
U Solar photovoltaic panels	+ 9.6	-£ 672	-947 kg (88.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£78	2.00 kg/m ²	B 86 B 89
Solar photovoltaic panels	£672	10.07 kg/m ²	A 95 A 97
Total Savings	£750	12.07 kg/m ²	

Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£180	£199	-£18
Mains gas	£556	£459	£97
Space heating	£396	£396	£0
Water heating	£188	£110	£78
Lighting	£152	£152	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£736	-£14	£751
Total cost of uses	£736	-£14	£750
Delivered energy	55 kWh/m ²	25 kWh/m ²	29 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.1 tonnes
CO2 emissions per m ²	13 kg/m ²	1 kg/m ²	12 kg/m ²
Primary energy	76 kWh/m ²	5 kWh/m ²	71 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3459 (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	0.4410	0.4324	0.4237	0.3805	0.3719	0.3286	0.3286	0.3200	0.3459	0.3719	0.3892	0.4064 (22b)
Effective ac	0.5973	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.8922	47.5894	47.2925	45.8983	45.6374	44.4230	44.4230	44.1982	44.8908	45.6374	46.1651	46.7168 (38)
Average = Sum(39)m / 12 =	108.3729	108.0700	107.7732	106.3789	106.1181	104.9037	104.9037	104.6788	105.3715	106.1181	106.6458	107.1975 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1529	1.1497	1.1465	1.1317	1.1289	1.1160	1.1160	1.1136	1.1210	1.1289	1.1345	1.1404 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850	14.6803 (61)
Total heat required for water heating calculated for each month	174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1790 (H8)
Utilisation factor												0.5718 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.7695 (H14)
Volume ratio Veff/V												0.7671 (H15)
Solar storage volume factor												0.9470 (H16)
Solar input	-25.0402	-41.7849	-71.1644	-95.3744	-117.8270	-115.8427	-114.3118	-99.8748	-78.2220	-53.4164	-29.7013	-863.5142 (H17)
Solar input (sum of months) = Sum(63)m =												-863.5142 (63)
Output from w/h	149.1435	110.9641	87.4238	44.2356	17.1334	2.0959	0.0000	25.1343	47.6648	91.4907	126.7168	148.1818 (64)
Total per year (kWh/year) = Sum(64)m =												850.1846 (64)
Heat gains from water heating, kWh/month	56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267 (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	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606	(72)
Total internal gains	612.5903	607.5915	583.5645	546.4305	508.3626	474.5143	454.9617	464.0615	485.6522	523.0094	564.3930	595.7476	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.1200	11.2829		0.4600		0.0000		0.7700		16.4652 (75)
Southwest				4.4900	36.7938		0.4600		0.0000		0.7700		58.5154 (79)
Northwest				1.5400	11.2829		0.4600		0.0000		0.7700		6.1545 (81)
Southwest				3.3300	36.7938		0.4600		0.0000		0.7700		43.3978 (79)

Solar gains	124.5329	219.6390	320.4764	430.5365	512.7690	522.4911	498.1481	434.7458	358.2674	248.1287	150.5300		105.6888 (83)
Total gains	737.1232	827.2305	904.0409	976.9670	1021.1316	997.0053	953.1099	898.8073	843.9196	771.1381	714.9230		701.4364 (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	34.6846	34.7818	34.8776	35.3348	35.4216	35.8317	35.8317	35.9086	35.6726	35.4216	35.2463	35.0649
alpha	3.3123	3.3188	3.3252	3.3557	3.3614	3.3888	3.3888	3.3939	3.3782	3.3614	3.3498	3.3377
util living area	0.9691	0.9537	0.9246	0.8634	0.7574	0.6035	0.4620	0.5038	0.7111	0.8858	0.9530	0.9733 (86)
MIT	19.3546	19.5703	19.9065	20.3297	20.6772	20.8942	20.9677	20.9564	20.8076	20.3642	19.7908	19.3147 (87)
Th 2	19.9579	19.9605	19.9630	19.9750	19.9773	19.9878	19.9878	19.9897	19.9837	19.9773	19.9727	19.9680 (88)
util rest of house	0.9633	0.9450	0.9102	0.8366	0.7096	0.5278	0.3645	0.4052	0.6418	0.8577	0.9428	0.9682 (89)
MIT 2	17.7870	18.0981	18.5790	19.1767	19.6369	19.9011	19.9701	19.9640	19.8098	19.2383	18.4277	17.7360 (90)
Living area fraction									fLA = Living area / (4) =			0.1809 (91)
MIT	18.0705	18.3644	18.8190	19.3852	19.8250	20.0807	20.1505	20.1435	19.9903	19.4419	18.6742	18.0215 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9205	18.2144	18.6690	19.2352	19.6750	19.9307	20.0005	19.9935	19.8403	19.2919	18.5242	17.8715 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9472	0.9255	0.8873	0.8136	0.6938	0.5232	0.3658	0.4056	0.6308	0.8343	0.9232	0.9535	(94)
Useful gains	698.1779	765.5735	802.1440	794.8986	708.4540	521.6367	348.6289	364.5288	532.3800	643.3815	659.9814	668.8383	(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	1476.0905	1438.8830	1311.4956	1099.4513	846.2945	559.2137	356.7236	376.1585	604.8631	922.3712	1218.3443	1465.5537	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	578.7670	452.4640	378.9576	219.2779	102.5533	0.0000	0.0000	0.0000	0.0000	207.5683	402.0213	592.7562	(98)
Space heating												2934.3657	(98)
Space heating per m2												31.2167	(99)

(98) / (4) = 31.2167 (99)

8c. Space cooling requirement

Not applicable

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3242.3931 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.7670	452.4640	378.9576	219.2779	102.5533	0.0000	0.0000	0.0000	0.0000	207.5683	402.0213	592.7562	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	639.5215	499.9603	418.7377	242.2961	113.3185	0.0000	0.0000	0.0000	0.0000	229.3572	444.2225	654.9793	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	149.1435	110.9641	87.4238	44.2356	17.1334	2.0959	0.0000	25.1343	47.6648	91.4907	126.7168	148.1818	(64)
Efficiency of water heater	89.8254	89.8514	89.8824	89.9465	90.0276	87.3000	87.3000	87.3000	87.3000	89.4964	89.7119	89.8414	(216)
Fuel for water heating, kWh/month	166.0371	123.4975	97.2646	49.1799	19.0313	2.4008	0.0000	28.7907	54.5988	102.2284	141.2486	164.9371	(219)
Water heating fuel used												949.2147	(219)
Annual totals kWh/year													
Space heating fuel - main system													3242.3931 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													413.7723 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394 (233)
Total delivered energy for all uses													3003.1407 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3242.3931	3.4800	112.8353	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.2147	3.4800	33.0327	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	413.7723	13.1900	54.5766	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			109.1091	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.3297 (257)
SAP value			95.4009
SAP rating (Section 12)			95 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3242.3931	0.2160	700.3569 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.2147	0.2160	205.0304 (264)
Space and water heating			905.3873 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			288.5729 (272)
CO2 emissions per m2			3.0700 (273)
EI value			97.2181
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.0000 (1b)	x 2.5400 (2b)	= 119.3800 (1b) - (3b)
First floor	47.0000 (1c)	x 2.6300 (2c)	= 123.6100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 242.9900 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1235 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3740 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3459 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3632	0.3459	0.3459	0.3200	0.3200	0.2854	0.2940	0.2767	0.2854	0.3027	0.3027	0.3286 (22b)
Effective ac	0.5660	0.5598	0.5598	0.5512	0.5512	0.5407	0.5432	0.5383	0.5407	0.5458	0.5458	0.5540 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.1500	1.2357	12.5428		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
EW Brick AAC015	100.3000	15.6100	84.6900	0.2500	21.1725	52.3000	4429.2870 (29a)
Plane Ceiling	47.0000		47.0000	0.1600	7.5200	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m ²)			194.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7593		(33)
E-WM-30			48.0000	0.0000	0.0000	45.0000	2160.0000 (32)
GF Timber			90.2200			9.0000	811.9800 (32c)
1F Timber			101.5200			9.0000	913.6800 (32c)
Internal Floor			47.0000			18.0000	846.0000 (32d)
Internal Ceiling			47.0000			9.0000	423.0000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13531.9470 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.9569 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.7214 (36)
 Total fabric heat loss (33) + (36) = 60.4807 (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	45.3825	44.8908	44.8908	44.1982	44.1982	43.3586	43.5595	43.1637	43.3586	43.7664	43.7664	44.4230 (38)
Heat transfer coeff	105.8632	105.3715	105.3715	104.6788	104.6788	103.8393	104.0402	103.6444	103.8393	104.2471	104.2471	104.9037 (39)
Average = Sum(39)m / 12 =												104.5604 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1262	1.1210	1.1210	1.1136	1.1136	1.1047	1.1068	1.1026	1.1047	1.1090	1.1090	1.1160 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1538.2950 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	14.6954	13.2595	14.6475	14.1190	14.5489	14.0326	14.4711	14.5215	14.0797	14.6067	14.1850 (61)
Total heat required for water heating calculated for each month											
174.1837	152.7490	158.5882	139.6100	134.9604	117.9386	110.7553	125.0091	125.8868	144.9071	156.4181	169.1362 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-27.1010	-40.7328	-68.5991	-94.8250	-114.2012	-120.1918	-117.3057	-104.7547	-81.7614	-55.6208	-32.9420
Solar input (sum of months) = Sum (63)m =											
Output from w/h	147.0827	112.0163	89.9891	44.7850	20.7593	0.0000	0.0000	20.2543	44.1253	89.2863	123.4761
Heat gains from water heating, kWh/month	56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387
56.7037	49.6951	51.5221	45.2555	43.6741	38.0569	35.6323	40.3675	40.6958	46.9766	50.8387	55.0267 (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	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966	160.5966 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5738	52.0247	42.3093	32.0309	23.9435	20.2141	21.8420	28.3911	38.1065	48.3849	56.4723	60.2017 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	367.5334	371.3472	361.7365	341.2763	315.4490	291.1749	274.9584	271.1445	280.7553	301.2155	327.0428	351.3169 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363	53.7363 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644 (71)
Water heating gains (Table 5)	76.2146	73.9511	69.2502	62.8548	58.7017	52.8568	47.8928	54.2574	56.5219	63.1405	70.6094	73.9606 (72)
Total internal gains	612.5903	607.5915	583.5645	546.4305	508.3626	474.5143	454.9617	464.0615	485.6522	523.0094	564.3930	595.7476 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				4.1200	12.9236	0.4600		0.0000		0.7700		18.8594 (75)	
Southwest				4.4900	40.4699	0.4600		0.0000		0.7700		64.3617 (79)	
Northwest				1.5400	12.9236	0.4600		0.0000		0.7700		7.0494 (81)	
Southwest				3.3300	40.4699	0.4600		0.0000		0.7700		47.7337 (79)	

Solar gains	138.0041	219.4739	317.7435	442.4100	515.2783	562.6201	530.3284	471.9901	385.9102	265.1170	170.9819	115.9424 (83)	
Total gains	750.5944	827.0655	901.3080	988.8405	1023.6409	1037.1344	985.2901	936.0516	871.5624	788.1264	735.3748	711.6900 (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	35.5069	35.6726	35.6726	35.9086	35.9086	36.1990	36.1291	36.2670	36.1990	36.0574	36.0574	35.8317
alpha	3.3671	3.3782	3.3782	3.3939	3.3939	3.4133	3.4086	3.4178	3.4133	3.4038	3.4038	3.3888
util living area	0.9624	0.9469	0.9108	0.8303	0.6896	0.4759	0.3224	0.3477	0.6158	0.8488	0.9388	0.9672 (86)
MIT	19.5462	19.7279	20.0725	20.4824	20.8004	20.9610	20.9926	20.9905	20.9003	20.5273	19.9892	19.5137 (87)
Th 2	19.9795	19.9837	19.9837	19.9897	19.9897	19.9970	19.9953	19.9987	19.9970	19.9935	19.9935	19.9878 (88)
util rest of house	0.9551	0.9368	0.8934	0.7972	0.6302	0.3895	0.2202	0.2420	0.5319	0.8115	0.9251	0.9608 (89)
MIT 2	18.0775	18.3397	18.8281	19.3939	19.7972	19.9722	19.9931	19.9956	19.9200	19.4693	18.7244	18.0367 (90)
Living area fraction										fLA = Living area / (4) =		0.1809 (91)
MIT	18.3431	18.5908	19.0532	19.5908	19.9787	20.1510	20.1738	20.1756	20.0973	19.6607	18.9532	18.3038 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1931	18.4408	18.9032	19.4408	19.8287	20.0010	20.0238	20.0256	19.9473	19.5107	18.8032	18.1538 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9376	0.9166	0.8703	0.7762	0.6198	0.3898	0.2232	0.2449	0.5274	0.7901	0.9040	0.9446	(94)
Useful gains	703.7486	758.1163	784.4102	767.5738	634.4859	404.2988	219.9127	229.2143	459.6458	622.7061	664.7516	672.2563	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1386.0753	1353.0500	1212.1070	998.7197	714.8158	415.4648	220.9637	230.6661	492.9551	824.6622	1126.1975	1369.3893	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	507.6510	399.7955	318.2065	166.4250	59.7654	0.0000	0.0000	0.0000	0.0000	150.2553	332.2410	518.6669	(98)
Space heating												2453.0067	(98)
Space heating per m2											(98) / (4) =	26.0958	(99)

8c. Space cooling requirement

Not applicable

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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2710.5046	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	507.6510	399.7955	318.2065	166.4250	59.7654	0.0000	0.0000	0.0000	0.0000	150.2553	332.2410	518.6669	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	560.9404	441.7630	351.6094	183.8951	66.0392	0.0000	0.0000	0.0000	0.0000	166.0279	367.1172	573.1126	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	147.0827	112.0163	89.9891	44.7850	20.7593	0.0000	0.0000	20.2543	44.1253	89.2863	123.4761	146.6828	(64)	
Efficiency of water heater	89.7609	89.7797	89.7745	89.8020	89.6528	87.3000	87.3000	87.3000	87.3000	89.2802	89.6100	87.3000	(216)	
(217)m	89.7609	89.7797	89.7745	89.8020	89.6528	87.3000	87.3000	87.3000	87.3000	89.2802	89.6100	87.3000	(217)	
Fuel for water heating, kWh/month	163.8605	124.7679	100.2389	49.8708	23.1552	0.0000	0.0000	23.2008	50.5445	100.0069	137.7927	163.3902	(219)	
Water heating fuel used												936.8284	(219)	
Annual totals kWh/year												2710.5046	(211)	
Space heating fuel - main system												0.0000	(215)	
Space heating fuel - secondary														
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													413.7723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)	
Total delivered energy for all uses													2361.9457	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2710.5046	9.7400	264.0031	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.8284	9.7400	91.2471	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	413.7723	36.8500	152.4751	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			-14.4150	(255)

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	2710.5046	0.2160	585.4690	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.8284	0.2160	202.3549	(264)
Space and water heating			787.8239	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	413.7723	0.5190	214.7478	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			120.7079 (272)

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	2710.5046	1.2200	3306.8156 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	936.8284	1.2200	1142.9307 (264)
Space and water heating			4449.7463 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	413.7723	3.0700	1270.2811 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			503.6073 (272)
Primary energy kWh/m2/year			5.3575 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	144.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	320.75 (P1)
Transmission heat loss coefficient	60.48 (37)
Summer heat loss coefficient	381.23 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.1200	98.8453	0.4600	0.0000	0.9000	168.5984
South West	4.4900	119.9223	0.4600	0.0000	0.9000	222.9189
North West	1.5400	98.8453	0.4600	0.0000	0.9000	63.0198
South West	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273
total:						619.8644

	Jun	Jul	Aug	
Solar gains	658	620	552	(P4)
Internal gains	472	452	461	
Total summer gains	1129	1072	1013	(P5)
Summer gain/loss ratio	2.96	2.81	2.66	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 144.0)	0.99	0.99	0.99	
Threshold temperature	19.95	21.70	21.45	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			