

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-576				Issued on Date	22/03/2023
Assessment Reference	Plot 576	Prop Type Ref	3-As-SEMI			
Property	Plot 576, 3 Bed, K, WC, B					
SAP Rating	85 B	DER	15.91	TER	17.39	
Environmental	87 B	% DER<TER	8.51			
CO ₂ Emissions (t/year)	1.24	DFEE	43.45	TFEE	50.37	
General Requirements Compliance	Pass	% DFEE<TFEE	13.75			
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) 17.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 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 East: 1.54 m², No overhang
Windows facing South West: 7.82 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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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)
Southeast				1.5400		36.7938		0.4600		0.0000		0.7700		20.0699 (77)
Southwest				4.4900		36.7938		0.4600		0.0000		0.7700		58.5154 (79)
Southwest				3.3300		36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384		(83)
Total gains	550.4890	651.0105	739.3675	821.8971	873.6383	855.9968	817.5901	765.5016	707.4321	621.0602	545.2912	517.4111		(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	0.9864	0.9757	0.9545	0.9065	0.8153	0.6711	0.5260	0.5734	0.7820	0.9311	0.9775	0.9889 (86)
MIT	19.0973	19.3393	19.7106	20.1810	20.5848	20.8529	20.9522	20.9353	20.7366	20.2057	19.5669	19.0569 (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	0.9836	0.9708	0.9449	0.8859	0.7728	0.5947	0.4197	0.4675	0.7183	0.9116	0.9721	0.9866 (89)
MIT 2	17.4162	17.7684	18.3051	18.9793	19.5273	19.8631	19.9606	19.9500	19.7356	19.0275	18.1095	17.3636 (90)
Living area fraction	17.7202	18.0525	18.5593	19.1966	19.7185	20.0421	20.1399	20.1282	19.9166	19.2406	18.3731	17.6699 (91)
MIT	17.7202	18.0525	18.5593	19.1966	19.7185	20.0421	20.1399	20.1282	19.9166	19.2406	18.3731	17.6699 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5702	17.9025	18.4093	19.0466	19.5685	19.8921	19.9899	19.9782	19.7666	19.0906	18.2231	17.5199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9739	0.9567	0.9254	0.8624	0.7530	0.5868	0.4199	0.4662	0.7024	0.8892	0.9586	0.9782	(94)	
Useful gains	536.1422	622.8059	684.2105	708.8351	657.8343	502.2755	343.3323	356.8852	496.8759	552.2325	522.7161	506.1301	(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	1438.1302	1405.1773	1283.5038	1079.3847	834.9917	555.1612	355.6128	374.5592	597.0978	901.0029	1186.2310	1427.8576	(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	671.0791	525.7535	445.8743	266.7957	131.8052	0.0000	0.0000	0.0000	0.0000	259.4852	477.7308	685.7653	(98)	
Space heating												3464.2890	(98)	
Space heating per m2												(98) / (4) =	36.8541	(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													3827.9437 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	671.0791	525.7535	445.8743	266.7957	131.8052	0.0000	0.0000	0.0000	0.0000	259.4852	477.7308	685.7653	(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)	741.5238	580.9431	492.6787	294.8019	145.6411	0.0000	0.0000	0.0000	0.0000	286.7240	527.8793	757.7517	(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	89.8215	89.7593	89.6380	89.3746	88.8523	87.3000	87.3000	87.3000	87.3000	89.3267	89.6891	87.3000	(216)
Fuel for water heating, kWh/month	193.9220	170.1763	176.9208	156.2076	151.8930	135.0958	126.8674	143.1948	144.2002	162.2215	174.4003	188.2461	(219)
Water heating fuel used												1923.3458	(219)
Annual totals kWh/year													
Space heating fuel - main system												3827.9437	(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												6240.0618	(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	3827.9437	0.2160	826.8358	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1923.3458	0.2160	415.4427	(264)
Space and water heating			1242.2785	(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			1495.9514	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9100	(273)

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

DER		15.9100	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		33.3829	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		33.3829	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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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)			
Southeast				1.5400	36.7938	0.6300	0.7000	0.7700	17.3168 (77)			
Southwest				7.8200	36.7938	0.6300	0.7000	0.7700	87.9333 (79)			
Solar gains	119.4568	208.1980	297.3997	389.5018	455.4507	460.5921	440.5497	390.0593	329.0925	233.4826	143.9410	101.6740 (83)
Total gains	543.6828	630.1012	704.2405	771.4774	812.0779	792.9657	757.7552	714.3464	666.6300	596.1087	534.6051	513.4371 (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)	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	0.9983	0.9961	0.9897	0.9675	0.9002	0.7487	0.5760	0.6288	0.8633	0.9787	0.9964	0.9988	(86)
MIT	19.7777	19.9307	20.1732	20.4913	20.7700	20.9408	20.9879	20.9812	20.8678	20.5066	20.0849	19.7540	(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	0.9978	0.9947	0.9860	0.9548	0.8606	0.6609	0.4550	0.5071	0.7967	0.9681	0.9949	0.9983	(89)
MIT 2	18.3506	18.5757	18.9301	19.3939	19.7707	19.9728	20.0091	20.0077	19.9003	19.4231	18.8103	18.3231	(90)
Living area fraction	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(91)
MIT	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(92)
Temperature adjustment	18.6087	18.8208	19.1549	19.5924	19.9514	20.1479	20.1862	20.1838	20.0753	19.6191	19.0408	18.5819	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9925	0.9816	0.9480	0.8582	0.6739	0.4769	0.5289	0.8019	0.9624	0.9927	0.9974	(94)
Ext temp.	541.8229	625.3520	691.3117	731.3922	696.8991	534.3831	361.3714	377.8468	534.5436	573.7094	530.7186	512.1164	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1507.7178	1462.6384	1325.8874	1105.3995	850.9052	565.3902	365.4683	384.7571	611.7350	930.0661	1237.6482	1498.5735	(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)
Space heating	718.6258	562.6565	472.1243	269.2852	114.5806	0.0000	0.0000	0.0000	0.0000	265.1294	508.9893	733.9241	(98)
Space heating per m2												3645.3152	(98)
												38.7799	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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													3902.9071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	718.6258	562.6565	472.1243	269.2852	114.5806	0.0000	0.0000	0.0000	0.0000	265.1294	508.9893	733.9241	(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)	769.4066	602.4159	505.4864	288.3139	122.6773	0.0000	0.0000	0.0000	0.0000	283.8644	544.9565	785.7860	(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	87.8958	87.6659	87.1970	86.1647	84.1211	80.3000	80.3000	80.3000	80.3000	86.0093	87.3944	80.3000	(216)
Fuel for water heating, kWh/month	239.4280	211.6181	223.3555	200.4785	198.8139	183.4366	175.7462	195.9159	198.0796	210.5809	219.1767	233.4787	(219)
Water heating fuel used												2490.1088	(219)
Annual totals kWh/year													
Space heating fuel - main system												3902.9071	(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												6881.7882	(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	3902.9071	0.2160	843.0279 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2490.1088	0.2160	537.8635 (264)
Space and water heating			1380.8914 (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			1634.5643 (272)
Emissions per m2 for space and water heating			14.6903 (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) = (14.6903 * 1.00) + 2.2846 + 0.4141, rounded to 2 d.p.			17.3900 (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		(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	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)
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)
Southeast				1.5400		36.7938		0.4600		0.0000		0.7700		20.0699 (77)
Southwest				4.4900		36.7938		0.4600		0.0000		0.7700		58.5154 (79)
Southwest				3.3300		36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384	(83)	
Total gains	516.8271	618.1688	708.2293	793.0795	846.3283	830.8067	794.1978	739.8015	680.9088	592.1359	513.6604	484.5660	(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	0.9887	0.9790	0.9593	0.9140	0.8260	0.6841	0.5386	0.5885	0.7962	0.9388	0.9810	0.9908	(86)
MIT	19.0492	19.2941	19.6710	20.1505	20.5648	20.8437	20.9486	20.9300	20.7198	20.1719	19.5230	19.0094	(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	0.9864	0.9747	0.9506	0.8946	0.7848	0.6080	0.4308	0.4815	0.7342	0.9211	0.9764	0.9889	(89)
MIT 2	18.1749	18.4195	18.7929	19.2670	19.6535	19.8967	19.9677	19.9601	19.8018	19.2974	18.6575	18.1427	(90)
Living area fraction	18.3330	18.5777	18.9517	19.4268	19.8183	20.0679	20.1451	20.1355	19.9678	19.4555	18.8140	18.2995	(92)
Temperature adjustment	18.3330	18.5777	18.9517	19.4268	19.8183	20.0679	20.1451	20.1355	19.9678	19.4555	18.8140	18.2995	(93)
adjusted MIT	18.3330	18.5777	18.9517	19.4268	19.8183	20.0679	20.1451	20.1355	19.9678	19.4555	18.8140	18.2995	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	507.1758	597.7735	665.6056	699.5608	658.0348	510.6091	356.2134	368.4801	499.1502	538.6268	497.9228	477.1239	(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	1520.7968	1478.1454	1341.9628	1119.8278	861.5015	573.6073	371.8918	391.0237	618.3023	939.7335	1249.2519	1511.4280	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	754.1340	591.6099	503.2098	302.5922	151.3792	0.0000	0.0000	0.0000	0.0000	298.4234	540.9569	769.5222	(98)
Space heating													3911.8277 (98)
Space heating per m2													41.6152 (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	0.8037	0.8667	0.8411	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	792.5100	672.7816	669.1789	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1073.2673	1028.3620	966.7569	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	202.1453	264.5519	221.3981	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			688.0952 (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	50.5363	66.1380	55.3495	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												172.0238 (107)
Energy for space heating												1.8300 (108)
Energy for space cooling												41.6152 (99)
Total												1.8300 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.4452 (109)
												43.4 (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	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					5.0000
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	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	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)			
Southeast				1.5400	36.7938	0.6300	0.7000	0.7700	17.3168 (77)			
Southwest				7.8200	36.7938	0.6300	0.7000	0.7700	87.9333 (79)			
Solar gains	119.4568	208.1980	297.3997	389.5018	455.4507	460.5921	440.5497	390.0593	329.0925	233.4826	143.9410	101.6740 (83)
Total gains	497.8356	585.0690	660.9481	731.1557	773.9198	757.5808	724.1583	677.7890	628.5889	555.0163	490.7763	468.4016 (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)	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	0.9989	0.9972	0.9922	0.9737	0.9145	0.7716	0.5994	0.6567	0.8847	0.9842	0.9976	0.9992	(86)	
MIT	19.7320	19.8863	20.1318	20.4565	20.7465	20.9316	20.9855	20.9771	20.8482	20.4692	20.0414	19.7089	(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	0.9985	0.9962	0.9893	0.9631	0.8785	0.6852	0.4751	0.5324	0.8235	0.9760	0.9965	0.9989	(89)	
MIT 2	18.8231	18.9791	19.2253	19.5538	19.8253	19.9808	20.0099	20.0089	19.9215	19.5715	19.1442	18.8082	(90)	
Living area fraction									fLA = Living area / (4) =			0.1809	(91)	
MIT	18.9875	19.1432	19.3892	19.7171	19.9919	20.1527	20.1863	20.1840	20.0891	19.7338	19.3065	18.9711	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9875	19.1432	19.3892	19.7171	19.9919	20.1527	20.1863	20.1840	20.0891	19.7338	19.3065	18.9711	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9980	0.9951	0.9870	0.9593	0.8780	0.6986	0.4978	0.5550	0.8294	0.9730	0.9955	0.9985	(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	(95)	
Heat loss rate W	1547.6337	1496.5118	1350.4389	1118.2935	855.0775	565.8824	365.4877	384.7785	613.1458	941.8994	1265.1809	1539.1249	(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	781.7972	614.4097	519.3780	300.1910	130.6354	0.0000	0.0000	0.0000	0.0000	298.9813	559.1497	797.1315	(98)	
Space heating												4001.6737	(98)	
Space heating per m2										(98) / (4) =		42.5710	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.8531	0.9192	0.8953	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	817.2100	693.1896	691.8941	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	987.6786	946.4976	894.2749	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	122.7374	188.4612	150.5712	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												461.7698	(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	30.6844	47.1153	37.6428	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												115.4425 (107)
Space cooling per m2												1.2281 (108)
Energy for space heating												42.5710 (99)
Energy for space cooling												1.2281 (108)
Total												43.7991 (109)
Target Fabric Energy Efficiency (TFEE)												50.4 (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 (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)		
	Total per year (kWh/year) = Sum (64)m =											1710.1423 (64)	
RHI water heating demand												1710 (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)
Southeast				1.5400	40.4699		0.4600		0.0000		0.7700		22.0750 (77)
Southwest				4.4900	40.4699		0.4600		0.0000		0.7700		64.3617 (79)
Southwest				3.3300	40.4699		0.4600		0.0000		0.7700		47.7337 (79)
Solar gains	153.0298	240.3201	340.3505	461.9808	528.6119	573.0827	541.8253	488.9020	409.1170	288.0752	188.9626		128.9649 (83)
Total gains	765.6201	847.9116	923.9150	1008.4113	1036.9745	1047.5970	996.7870	952.9635	894.7692	811.0846	753.3556		724.7125 (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												
	0.9603	0.9434	0.9055	0.8238	0.6840	0.4718	0.3189	0.3418	0.6041	0.8398	0.9349	0.9656 (86)
MIT	19.5657	19.7533	20.0963	20.4971	20.8055	20.9620	20.9929	20.9910	20.9060	20.5458	20.0105	19.5309 (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												
	0.9527	0.9328	0.8874	0.7899	0.6245	0.3859	0.2177	0.2378	0.5206	0.8013	0.9206	0.9589 (89)
MIT 2	18.1052	18.3754	18.8605	19.4125	19.8026	19.9729	19.9931	19.9958	19.9249	19.4923	18.7538	18.0613 (90)
Living area fraction										fLA = Living area / (4) =		0.1809 (91)
MIT	18.3693	18.6246	19.0840	19.6086	19.9840	20.1518	20.1739	20.1758	20.1023	19.6829	18.9811	18.3271 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2193	18.4746	18.9340	19.4586	19.8340	20.0018	20.0239	20.0258	19.9523	19.5329	18.8311	18.1771 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9347	0.9121	0.8641	0.7694	0.6144	0.3863	0.2207	0.2406	0.5165	0.7804	0.8991	0.9422 (94)
Useful gains	715.6613	773.4017	798.3677	775.8658	637.1338	404.6816	219.9614	229.3154	462.1833	632.9420	677.3186	682.8402 (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	1388.8533	1356.6176	1215.3578	1000.5857	715.3760	415.5430	220.9752	230.6893	493.4804	826.9776	1129.1121	1371.8356 (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	500.8548	391.9211	310.2406	161.7984	58.2121	0.0000	0.0000	0.0000	0.0000	144.3625	325.2913	512.6125 (98)
Space heating												2405.2935 (98)
RHI space heating demand												2405 (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	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys										0	+	0	+	0 = 0 * 40 = 0.0000 (6a)
Number of open flues										0	+	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)
										Air changes per hour				
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)							(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 107.5465	Feb 103.6357	Mar 99.7249	Apr 95.8141	May 91.9033	Jun 87.9926	Jul 87.9926	Aug 91.9033	Sep 95.8141	Oct 99.7249	Nov 103.6357	Dec 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 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 (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	11.2829	0.4600	0.0000	0.7700	16.4652 (75)				
Southeast				1.5400	36.7938	0.4600	0.0000	0.7700	20.0699 (77)				
Southwest				4.4900	36.7938	0.4600	0.0000	0.7700	58.5154 (79)				
Southwest				3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)				
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384	(83)
Total gains	751.0386	848.8892	928.2454	997.8562	1036.2219	1008.3323	965.5509	916.1332	867.0645	793.6116	731.2181	713.5860	(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	0.9675	0.9505	0.9197	0.8573	0.7516	0.5985	0.4568	0.4957	0.6996	0.8784	0.9502	0.9720 (86)
MIT	19.3731	19.5973	19.9333	20.3477	20.6854	20.8969	20.9688	20.9584	20.8174	20.3854	19.8111	19.3312 (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	0.9614	0.9413	0.9046	0.8298	0.7034	0.5229	0.3601	0.3982	0.6298	0.8491	0.9394	0.9667 (89)
MIT 2	17.8134	18.1363	18.6160	19.2003	19.6463	19.9035	19.9707	19.9653	19.8197	19.2659	18.4563	17.7596 (90)
Living area fraction	fLA = Living area / (4) =											0.1809 (91)
MIT	18.0954	18.4005	18.8542	19.4078	19.8342	20.0832	20.1512	20.1449	20.0002	19.4684	18.7013	18.0438 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9454	18.2505	18.7042	19.2578	19.6842	19.9332	20.0012	19.9949	19.8502	19.3184	18.5513	17.8938 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9449	0.9212	0.8814	0.8070	0.6880	0.5186	0.3614	0.3987	0.6196	0.8259	0.9194	0.9516	(94)
Useful gains	709.6249	782.0229	818.1316	805.2878	712.8963	522.8789	348.9927	365.2663	537.2185	655.4563	672.2457	679.0568	(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	1478.7949	1442.7878	1315.2898	1101.8515	847.2709	559.4706	356.7997	376.3120	605.9021	925.1802	1221.2308	1467.9422	(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	572.2625	444.0340	369.8857	213.5258	99.9747	0.0000	0.0000	0.0000	0.0000	200.6745	395.2693	586.9307	(98)
Space heating												2882.5574	(98)
Space heating per m2												(98) / (4) =	30.6655 (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													3185.1462 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	572.2625	444.0340	369.8857	213.5258	99.9747	0.0000	0.0000	0.0000	0.0000	200.6745	395.2693	586.9307	(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)	632.3343	490.6453	408.7135	235.9401	110.4693	0.0000	0.0000	0.0000	0.0000	221.7398	436.7616	648.5423	(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	89.7325	89.6588	89.5154	89.2073	88.6337	87.3000	87.3000	87.3000	87.3000	89.1301	89.5691	87.3000	(216)
Fuel for water heating, kWh/month	194.1144	170.3670	177.1631	156.5007	152.2677	135.0958	126.8674	143.1948	144.2002	162.5794	174.6339	188.4233	(219)
Water heating fuel used												1925.4076	(219)
Annual totals kWh/year													
Space heating fuel - main system												3185.1462	(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												5599.3262	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3185.1462	3.4800	110.8431 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1925.4076	3.4800	67.0042 (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			362.3163 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0948 (257)
SAP value		84.7280
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	3185.1462	0.2160	687.9916 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1925.4076	0.2160	415.8880 (264)
Space and water heating			1103.8796 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total kg/year			1357.5525 (272)
CO2 emissions per m2			14.4400 (273)
EI value			86.9128
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	$3.48 / 0.8870 = 3.923$, stars = 4
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, 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)	
Southeast					1.5400	40.4699	0.4600	0.0000	0.7700		22.0750 (77)	
Southwest					4.4900	40.4699	0.4600	0.0000	0.7700		64.3617 (79)	
Southwest					3.3300	40.4699	0.4600	0.0000	0.7700		47.7337 (79)	
Solar gains	153.0298	240.3201	340.3505	461.9808	528.6119	573.0827	541.8253	488.9020	409.1170	288.0752	188.9626	128.9649 (83)
Total gains	765.6201	847.9116	923.9150	1008.4113	1036.9745	1047.5970	996.7870	952.9635	894.7692	811.0846	753.3556	724.7125 (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	0.9603	0.9434	0.9055	0.8238	0.6840	0.4718	0.3189	0.3418	0.6041	0.8398	0.9349	0.9656	(86)
MIT	19.5657	19.7533	20.0963	20.4971	20.8055	20.9620	20.9929	20.9910	20.9060	20.5458	20.0105	19.5309	(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	0.9527	0.9328	0.8874	0.7899	0.6245	0.3859	0.2177	0.2378	0.5206	0.8013	0.9206	0.9589	(89)
MIT 2	18.1052	18.3754	18.8605	19.4125	19.8026	19.9729	19.9931	19.9958	19.9249	19.4923	18.7538	18.0613	(90)
Living area fraction	fLA = Living area / (4) =											0.1809	(91)
MIT	18.3693	18.6246	19.0840	19.6086	19.9840	20.1518	20.1739	20.1758	20.1023	19.6829	18.9811	18.3271	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2193	18.4746	18.9340	19.4586	19.8340	20.0018	20.0239	20.0258	19.9523	19.5329	18.8311	18.1771	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9347	0.9121	0.8641	0.7694	0.6144	0.3863	0.2207	0.2406	0.5165	0.7804	0.8991	0.9422	(94)	
Useful gains	715.6613	773.4017	798.3677	775.8658	637.1338	404.6816	219.9614	229.3154	462.1833	632.9420	677.3186	682.8402	(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	1388.8533	1356.6176	1215.3578	1000.5857	715.3760	415.5430	220.9752	230.6893	493.4804	826.9776	1129.1121	1371.8356	(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	500.8548	391.9211	310.2406	161.7984	58.2121	0.0000	0.0000	0.0000	0.0000	144.3625	325.2913	512.6125	(98)	
Space heating												2405.2935	(98)	
Space heating per m2												(98) / (4) =	25.5882	(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													2657.7829 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	500.8548	391.9211	310.2406	161.7984	58.2121	0.0000	0.0000	0.0000	0.0000	144.3625	325.2913	512.6125	(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)	553.4308	433.0620	342.8073	178.7827	64.3228	0.0000	0.0000	0.0000	0.0000	159.5166	359.4379	566.4227	(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	89.6520	89.5792	89.3916	88.9891	88.2402	87.3000	87.3000	87.3000	87.3000	88.8682	89.4355	87.3000	(216)
Fuel for water heating, kWh/month	194.2886	170.5185	177.4083	156.8843	152.9466	135.0958	126.8674	143.1948	144.2002	163.0585	174.8948	188.5903	(219)
Water heating fuel used												1927.9481	(219)
Annual totals kWh/year													
Space heating fuel - main system												2657.7829	(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												5074.5033	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2657.7829	9.7400	258.8681 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1927.9481	9.7400	187.7821 (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			730.7628 (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	2657.7829	0.2160	574.0811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1927.9481	0.2160	416.4368 (264)
Space and water heating			990.5179 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.7723	0.5190	214.7478 (268)
Total kg/year			1244.1907 (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	2657.7829	1.2200	3242.4951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1927.9481	1.2200	2352.0967 (264)
Space and water heating			5594.5918 (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			7095.1229 (272)
Primary energy kWh/m2/year			75.4800 (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 (15.1%)
U Solar photovoltaic panels	+ 9.6	-£ 672	-947 kg (89.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£78	2.00 kg/m²	B 86 B 89
Solar photovoltaic panels	£672	10.07 kg/m²	A 95 A 97
Total Savings	£750	12.07 kg/m²	

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	£551	£454	£97
Space heating	£391	£391	£0
Water heating	£188	£110	£78
Lighting	£152	£152	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£731	-£19	£751
Total cost of uses	£731	-£19	£750
Delivered energy	54 kWh/m²	25 kWh/m²	29 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.1 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	1 kg/m²	12 kg/m²
Primary energy	75 kWh/m²	5 kWh/m²	71 kWh/m²

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		(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)

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)			
Southeast				1.5400	36.7938	0.4600	0.0000	0.7700	20.0699 (77)			
Southwest				4.4900	36.7938	0.4600	0.0000	0.7700	58.5154 (79)			
Southwest				3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)			
Solar gains	138.4483	241.2977	344.6809	451.4257	527.8592	533.8180	510.5892	452.0718	381.4123	270.6022	166.8251	117.8384 (83)
Total gains	751.0386	848.8892	928.2454	997.8562	1036.2219	1008.3323	965.5509	916.1332	867.0645	793.6116	731.2181	713.5860 (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	0.9675	0.9505	0.9197	0.8573	0.7516	0.5985	0.4568	0.4957	0.6996	0.8784	0.9502	0.9720 (86)
MIT	19.3731	19.5973	19.9333	20.3477	20.6854	20.8969	20.9688	20.9584	20.8174	20.3854	19.8111	19.3312 (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	0.9614	0.9413	0.9046	0.8298	0.7034	0.5229	0.3601	0.3982	0.6298	0.8491	0.9394	0.9667 (89)
MIT 2	17.8134	18.1363	18.6160	19.2003	19.6463	19.9035	19.9707	19.9653	19.8197	19.2659	18.4563	17.7596 (90)
Living area fraction	18.0954	18.4005	18.8542	19.4078	19.8342	20.0832	20.1512	20.1449	20.0002	19.4684	18.7013	18.0438 (92)
MIT	17.9454	18.2505	18.7042	19.2578	19.6842	19.9332	20.0012	19.9949	19.8502	19.3184	18.5513	17.8938 (93)
Temperature adjustment												-0.1500
adjusted MIT												

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	0.9449	0.9212	0.8814	0.8070	0.6880	0.5186	0.3614	0.3987	0.6196	0.8259	0.9194	0.9516	(94)
Useful gains	709.6249	782.0229	818.1316	805.2878	712.8963	522.8789	348.9927	365.2663	537.2185	655.4563	672.2457	679.0568	(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	1478.7949	1442.7878	1315.2898	1101.8515	847.2709	559.4706	356.7997	376.3120	605.9021	925.1802	1221.2308	1467.9422	(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	572.2625	444.0340	369.8857	213.5258	99.9747	0.0000	0.0000	0.0000	0.0000	200.6745	395.2693	586.9307	(98)
Space heating												2882.5574	(98)
Space heating per m2											(98) / (4) =	30.6655	(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													3185.1462 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	572.2625	444.0340	369.8857	213.5258	99.9747	0.0000	0.0000	0.0000	0.0000	200.6745	395.2693	586.9307	(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)	632.3343	490.6453	408.7135	235.9401	110.4693	0.0000	0.0000	0.0000	0.0000	221.7398	436.7616	648.5423	(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	89.8193	89.8416	89.8702	89.9343	90.0173	87.3000	87.3000	87.3000	87.3000	89.4730	89.7018	87.3000	(216)
(217)m	89.8193	89.8416	89.8702	89.9343	90.0173	87.3000	87.3000	87.3000	87.3000	89.4730	89.7018	89.8362	(217)
Fuel for water heating, kWh/month	166.0483	123.5109	97.2777	49.1866	19.0335	2.4008	0.0000	28.7907	54.5988	102.2551	141.2645	164.9466	(219)
Water heating fuel used												949.3135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3185.1462	(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												2945.9927	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3185.1462	3.4800	110.8431	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.3135	3.4800	33.0361	(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			107.1204	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.3237 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	95.4848
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	3185.1462	0.2160	687.9916 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.3135	0.2160	205.0517 (264)
Space and water heating			893.0433 (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			276.2289 (272)
CO2 emissions per m2			2.9400 (273)
EI value			97.3371
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 (63)
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	146.6828 (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)
Southeast					1.5400	40.4699	0.4600	0.0000			0.7700	22.0750 (77)
Southwest					4.4900	40.4699	0.4600	0.0000			0.7700	64.3617 (79)
Southwest					3.3300	40.4699	0.4600	0.0000			0.7700	47.7337 (79)
Solar gains	153.0298	240.3201	340.3505	461.9808	528.6119	573.0827	541.8253	488.9020	409.1170	288.0752	188.9626	128.9649 (83)
Total gains	765.6201	847.9116	923.9150	1008.4113	1036.9745	1047.5970	996.7870	952.9635	894.7692	811.0846	753.3556	724.7125 (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	0.9603	0.9434	0.9055	0.8238	0.6840	0.4718	0.3189	0.3418	0.6041	0.8398	0.9349	0.9656 (86)
MIT	19.5657	19.7533	20.0963	20.4971	20.8055	20.9620	20.9929	20.9910	20.9060	20.5458	20.0105	19.5309 (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	0.9527	0.9328	0.8874	0.7899	0.6245	0.3859	0.2177	0.2378	0.5206	0.8013	0.9206	0.9589 (89)
MIT 2	18.1052	18.3754	18.8605	19.4125	19.8026	19.9729	19.9931	19.9958	19.9249	19.4923	18.7538	18.0613 (90)
Living area fraction	18.3693	18.6246	19.0840	19.6086	19.9840	20.1518	20.1739	20.1758	20.1023	19.6829	18.9811	18.3271 (92)
MIT	18.2193	18.4746	18.9340	19.4586	19.8340	20.0018	20.0239	20.0258	19.9523	19.5329	18.8311	18.1771 (93)
Temperature adjustment												-0.1500
adjusted MIT												

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	0.9347	0.9121	0.8641	0.7694	0.6144	0.3863	0.2207	0.2406	0.5165	0.7804	0.8991	0.9422	(94)
Useful gains	715.6613	773.4017	798.3677	775.8658	637.1338	404.6816	219.9614	229.3154	462.1833	632.9420	677.3186	682.8402	(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	1388.8533	1356.6176	1215.3578	1000.5857	715.3760	415.5430	220.9752	230.6893	493.4804	826.9776	1129.1121	1371.8356	(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	500.8548	391.9211	310.2406	161.7984	58.2121	0.0000	0.0000	0.0000	0.0000	144.3625	325.2913	512.6125	(98)
Space heating												2405.2935	(98)
Space heating per m2											(98) / (4) =	25.5882	(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													2657.7829	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	500.8548	391.9211	310.2406	161.7984	58.2121	0.0000	0.0000	0.0000	0.0000	144.3625	325.2913	512.6125	(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)	553.4308	433.0620	342.8073	178.7827	64.3228	0.0000	0.0000	0.0000	0.0000	159.5166	359.4379	566.4227	(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	89.7532	89.7686	89.7602	89.7865	89.6363	87.3000	87.3000	87.3000	87.3000	89.2498	89.5964	87.3000	(216)	
(217)m	89.7532	89.7686	89.7602	89.7865	89.6363	87.3000	87.3000	87.3000	87.3000	89.2498	89.5964	89.7679	(217)	
Fuel for water heating, kWh/month	163.8746	124.7834	100.2549	49.8794	23.1594	0.0000	0.0000	23.2008	50.5445	100.0409	137.8137	163.4023	(219)	
Water heating fuel used												936.9539	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2657.7829	(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 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)	
Total delivered energy for all uses												2309.3494	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2657.7829	9.7400	258.8681	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.9539	9.7400	91.2593	(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			-19.5379	(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	2657.7829	0.2160	574.0811	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.9539	0.2160	202.3820	(264)
Space and water heating			776.4631	(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

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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			109.3471 (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	2657.7829	1.2200	3242.4951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	936.9539	1.2200	1143.0837 (264)
Space and water heating			4385.5788 (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			439.4398 (272)
Primary energy kWh/m2/year			4.6749 (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 East	0.000	1.000	None
South 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 East	1.000	0.90	1.000	0.900 (P8)
South 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 East	1.5400	119.9223	0.4600	0.0000	0.9000	76.4577
South West	4.4900	119.9223	0.4600	0.0000	0.9000	222.9189
South West	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273

total: 633.3023

	Jun	Jul	Aug	
Solar gains	670	633	571	(P4)
Internal gains	472	452	461	
Total summer gains	1141	1085	1033	(P5)

	2.99	2.85	2.71	
Summer gain/loss ratio	2.99	2.85	2.71	(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	19.99	21.74	21.50	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight