

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-574				Issued on Date	22/03/2023
Assessment Reference	Plot 574		Prop Type Ref	2-OP-SEMI		
Property	Plot 574, 2 Bed, K, WC, B					
SAP Rating	84 B	DER	16.77	TER	18.39	
Environmental	87 B	% DER<TER	8.81			
CO ₂ Emissions (t/year)	1.13	DFEE	45.04	TFEE	52.27	
General Requirements Compliance	Pass	% DFEE<TFEE	13.82			
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 80 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) 18.39 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.0 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): Medium OK

Based on:

Overshading:

Average

Windows facing North East: 3.63 m², No overhang

Windows facing South East: 2.47 m², No overhang

Windows facing South West: 8.01 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 0.038 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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.4658	0.4567	0.4476	0.4019	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4110	0.4293 (22b)
Effective ac	0.6085	0.6043	0.6002	0.5808	0.5771	0.5602	0.5602	0.5571	0.5667	0.5771	0.5845	0.5922 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (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) = 11877.0680 (34)
147.8719 (35)
6.6335 (36)
(33) + (36) = 57.1986 (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	41.6928	41.4042	41.1212	39.7921	39.5434	38.3858	38.3858	38.1715	38.8317	39.5434	40.0465	40.5724 (38)
Heat transfer coeff	98.8914	98.6027	98.3198	96.9907	96.7420	95.5844	95.5844	95.3700	96.0303	96.7420	97.2450	97.7710 (39)
Average = Sum(39)m / 12 =												96.9895 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2312	1.2276	1.2241	1.2076	1.2045	1.1900	1.1900	1.1874	1.1956	1.2045	1.2107	1.2173 (40)
HLP (average)												1.2075 (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)
2.4689 (42)
92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (45)

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Energy content (annual)												Total = Sum(45)m = 1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994 (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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570	14.6569 (61)
Total heat required for water heating calculated for each month	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (64)
Heat gains from water heating, kWh/month	54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296 (65)
Total per year (kWh/year) = Sum(64)m =												1632.1614 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1223	17.8724	14.5348	11.0038	8.2255	6.9443	7.5036	9.7534	13.0910	16.6220	19.4004	20.6815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	375.8741	373.7566	360.1950	338.3391	316.1504	294.7828	280.9172	286.9257	298.1688	320.2367	345.5785	364.5813	(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					3.6300	11.2829	0.4600	0.0000			0.7700	14.5070 (75)
Southeast					2.4700	36.7938	0.4600	0.0000			0.7700	32.1900 (77)
Southwest					4.6800	36.7938	0.4600	0.0000			0.7700	60.9915 (79)
Southwest					3.3300	36.7938	0.4600	0.0000			0.7700	43.3978 (79)

Solar gains	151.0863	262.1745	371.5177	481.7818	559.2174	563.7868	539.9662	480.8789	409.4962	293.2096	181.8441	128.7306 (83)
Total gains	526.9604	635.9311	731.7128	820.1209	875.3678	858.5695	820.8834	767.8046	707.6650	613.4464	527.4226	493.3118 (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	33.3617	33.4594	33.5557	34.0155	34.1029	34.5159	34.5159	34.5935	34.3557	34.1029	33.9265	33.7440
alpha	3.2241	3.2306	3.2370	3.2677	3.2735	3.3011	3.3011	3.3062	3.2904	3.2735	3.2618	3.2496
util living area	0.9827	0.9681	0.9403	0.8808	0.7764	0.6253	0.4832	0.5291	0.7411	0.9121	0.9712	0.9859 (86)
MIT	19.0841	19.3560	19.7510	20.2326	20.6254	20.8721	20.9592	20.9445	20.7643	20.2399	19.5735	19.0387 (87)
Th 2	19.8951	19.8980	19.9008	19.9140	19.9164	19.9280	19.9280	19.9301	19.9235	19.9164	19.9114	19.9062 (88)
util rest of house	0.9791	0.9616	0.9278	0.8552	0.7278	0.5450	0.3770	0.4219	0.6701	0.8877	0.9641	0.9829 (89)
MIT 2	17.3547	17.7490	18.3168	19.0001	19.5231	19.8246	19.9063	19.8982	19.7110	19.0271	18.0764	17.2957 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	17.7879	18.1515	18.6761	19.3089	19.7992	20.0870	20.1700	20.1603	19.9749	19.3309	18.4514	17.7323 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6379	18.0015	18.5261	19.1589	19.6492	19.9370	20.0200	20.0103	19.8249	19.1809	18.3014	17.5823 (93)

8. Space heating requirement

Utilisation	0.9682	0.9459	0.9072	0.8336	0.7142	0.5458	0.3865	0.4304	0.6627	0.8663	0.9493	0.9734	(94)
Useful gains	510.1850	601.5062	663.8396	683.6783	625.1918	468.5770	317.3020	330.4788	468.9633	531.4502	500.6644	480.1921	(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	1319.0084	1291.8478	1182.4002	995.0139	769.0251	510.1310	326.9009	344.3130	549.7611	830.1309	1089.2795	1308.4024	(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	601.7646	463.9095	385.8091	224.1616	107.0120	0.0000	0.0000	0.0000	0.0000	222.2185	423.8029	616.1884	(98)
Space heating												3044.8666	(98)
Space heating per m2												(98) / (4) = 37.9092	(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												3364.4935 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	601.7646	463.9095	385.8091	224.1616	107.0120	0.0000	0.0000	0.0000	0.0000	222.2185	423.8029	616.1884 (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)	664.9333	512.6072	426.3084	247.6924	118.2453	0.0000	0.0000	0.0000	0.0000	245.5453	468.2905	680.8712 (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	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (64)
Efficiency of water heater (217)m	89.7880	89.7141	89.5752	89.2800	88.7233	87.3000	87.3000	87.3000	87.3000	89.2451	89.6443	87.3000 (216)
Fuel for water heating, kWh/month	185.0051	162.3865	168.8897	149.2415	145.2294	129.0595	121.2740	136.7748	137.7020	154.9602	166.4507	179.6094 (219)
Water heating fuel used												1836.5827 (219)
Annual totals kWh/year												
Space heating fuel - main system												3364.4935 (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)												355.3658 (232)
Total delivered energy for all uses												5631.4420 (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	3364.4935	0.2160	726.7306 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1836.5827	0.2160	396.7019 (264)
Space and water heating			1123.4325 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total CO2, kg/year			1346.7923 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.7700 (273)

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

DER		16.7700 ZC1
Total Floor Area	TFA	80.3200
Assumed number of occupants	N	2.4689
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2390 ZC2
CO2 emissions from cooking, equation (L16)		2.2193 ZC3
Total CO2 emissions		35.2283 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		35.2283 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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) =	0.1445 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3945 (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) =							0.3649 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4653	0.4561	0.4470	0.4014	0.3923	0.3467	0.3467	0.3375	0.3649	0.3923	0.4105	0.4288	(22a)				
Effective ac	0.6082	0.6040	0.5999	0.5806	0.5769	0.5601	0.5601	0.5570	0.5666	0.5769	0.5843	0.5919	(22b)				
													(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			14.1100	1.3258	18.7064		(27)					
GF B&B J150 P/A=0.40			40.1600	0.1300	5.2208		(28a)					
EW Brick AAC015	92.7000	16.2400	76.4600	0.1800	13.7628		(29a)					
Plane Ceiling	40.1600		40.1600	0.1300	5.2208		(30)					
Total net area of external elements Aum(A, m2)			173.0200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0408		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8721 (36)					
Total fabric heat loss						(33) + (36) =	54.9129 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.6740	Feb 41.3861	Mar 41.1038	Apr 39.7781	May 39.5301	Jun 38.3754	Jul 38.3754	Aug 38.1616	Sep 38.8201	Oct 39.5301	Nov 40.0318	Dec 40.5564 (38)
Heat transfer coeff	96.5870	96.2990	96.0168	94.6910	94.4430	93.2883	93.2883	93.0745	93.7331	94.4430	94.9448	95.4694 (39)
Average = Sum(39)m / 12 =												94.6899 (39)
HLP	Jan 1.2025	Feb 1.1989	Mar 1.1954	Apr 1.1789	May 1.1758	Jun 1.1615	Jul 1.1615	Aug 1.1588	Sep 1.1670	Oct 1.1758	Nov 1.1821	Dec 1.1886 (40)
HLP (average)												1.1789 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
Daily hot water use	Jan 102.1201	Feb 98.4067	Mar 94.6932	Apr 90.9798	May 87.2663	Jun 83.5528	Jul 83.5528	Aug 87.2663	Sep 90.9798	Oct 94.6932	Nov 98.4067	Dec 102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (45)
Energy content (annual)										Total = Sum(45)m =		1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994 (46)
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 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	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589 (61)
Solar input	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216 (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	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216 (64)
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051 (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	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1223	17.8724	14.5348	11.0038	8.2255	6.9443	7.5036	9.7534	13.0910	16.6220	19.4004	20.6815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains	388.0676	385.6844	371.5020	349.0277	326.2155	304.2267	290.3700	296.9990	308.8697	331.5560	357.5134	376.7795	(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				3.6300	11.2829	0.6300	0.7000	0.7700	12.5170 (75)			
Southeast				2.4700	36.7938	0.6300	0.7000	0.7700	27.7743 (77)			
Southwest				8.0100	36.7938	0.6300	0.7000	0.7700	90.0698 (79)			
Solar gains	130.3612	226.2110	320.5552	415.6939	482.5074	486.4499	465.8969	414.9149	353.3240	252.9889	156.8998	111.0721 (83)
Total gains	518.4288	611.8954	692.0572	764.7216	808.7229	790.6766	756.2669	711.9139	662.1937	584.5450	514.4132	487.8516 (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	57.7488	57.9214	58.0917	58.9050	59.0597	59.7907	59.7907	59.9281	59.5070	59.0597	58.7476	58.4248	
alpha	4.8499	4.8614	4.8728	4.9270	4.9373	4.9860	4.9860	4.9952	4.9671	4.9373	4.9165	4.8950	
util living area	0.9972	0.9934	0.9830	0.9501	0.8640	0.6991	0.5307	0.5816	0.8224	0.9673	0.9940	0.9979	(86)
MIT	19.7306	19.9076	20.1744	20.5124	20.7910	20.9483	20.9893	20.9835	20.8809	20.5149	20.0603	19.7030	(87)
Th 2	19.9180	19.9208	19.9237	19.9369	19.9394	19.9510	19.9510	19.9531	19.9465	19.9394	19.9344	19.9291	(88)
util rest of house	0.9963	0.9911	0.9770	0.9317	0.8152	0.6062	0.4104	0.4591	0.7452	0.9515	0.9916	0.9972	(89)
MIT 2	18.2352	18.4950	18.8829	19.3703	19.7367	19.9170	19.9471	19.9465	19.8534	19.3840	18.7281	18.2028	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6098	18.8488	19.2064	19.6564	20.0008	20.1754	20.2082	20.2062	20.1108	19.6673	19.0618	18.5786	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6098	18.8488	19.2064	19.6564	20.0008	20.1754	20.2082	20.2062	20.1108	19.6673	19.0618	18.5786	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9946	0.9880	0.9717	0.9257	0.8184	0.6275	0.4407	0.4898	0.7589	0.9463	0.9888	0.9959	(94)
Ext temp.	515.6330	604.5349	672.4507	707.9016	661.8422	496.1112	333.2755	348.7308	502.5128	553.1278	508.6282	485.8596	(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	1382.1428	1343.2586	1220.0310	1018.5325	783.9502	520.1183	336.6012	354.2640	563.4095	856.3433	1135.7135	1372.7128	(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	644.6833	496.4223	407.3997	223.6543	90.8483	0.0000	0.0000	0.0000	0.0000	225.5923	451.5015	659.8188	(98)
Space heating per m2												3199.9205	(98)
												39.8396	(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												3426.0391 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	644.6833	496.4223	407.3997	223.6543	90.8483	0.0000	0.0000	0.0000	0.0000	225.5923	451.5015	659.8188 (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)	690.2391	531.5014	436.1881	239.4585	97.2680	0.0000	0.0000	0.0000	0.0000	241.5335	483.4063	706.4441 (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	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216 (64)
Efficiency of water heater (217)m	87.7625	87.4984	86.9842	85.8323	83.7031	80.3000	80.3000	80.3000	80.3000	85.7353	87.2285	80.3000 (216)
Fuel for water heating, kWh/month	230.6227	203.1414	212.6049	191.1004	189.7255	174.1812	166.8789	186.0308	188.0853	200.5950	210.4656	224.9453 (219)
Water heating fuel used												2378.3770 (219)
Annual totals kWh/year												
Space heating fuel - main system												3426.0391 (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)												355.3658 (232)
Total delivered energy for all uses												6234.7819 (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	3426.0391	0.2160	740.0244 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2378.3770	0.2160	513.7294 (264)
Space and water heating			1253.7539 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total CO2, kg/m2/year			1477.1137 (272)
Emissions per m2 for space and water heating			15.6095 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2963 (272b)
Emissions per m2 for pumps and fans			0.4846 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6095 * 1.00) + 2.2963 + 0.4846, rounded to 2 d.p.			18.3900 (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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.4658	0.4567	0.4476	0.4019	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4110	0.4293 (22b)
Effective ac	0.6085	0.6043	0.6002	0.5808	0.5771	0.5602	0.5602	0.5571	0.5667	0.5771	0.5845	0.5922 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11877.0680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.8719 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6335 (36)
Total fabric heat loss							(33) + (36) = 57.1986 (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	41.6928	41.4042	41.1212	39.7921	39.5434	38.3858	38.3858	38.1715	38.8317	39.5434	40.0465	40.5724 (38)
Heat transfer coeff	98.8914	98.6027	98.3198	96.9907	96.7420	95.5844	95.5844	95.3700	96.0303	96.7420	97.2450	97.7710 (39)
Average = Sum(39)m / 12 =												96.9895 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2312	1.2276	1.2241	1.2076	1.2045	1.1900	1.1900	1.1874	1.1956	1.2045	1.2107	1.2173 (40)
HLP (average)												1.2075 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 = 1460.6794 (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	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658 (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	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1223	17.8724	14.5348	11.0038	8.2255	6.9443	7.5036	9.7534	13.0910	16.6220	19.4004	20.6815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains	343.5183	342.1819	330.2425	310.5891	289.8313	270.4758	258.3169	262.1348	272.5967	292.3856	315.1535	333.0010	(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					3.6300	11.2829	0.4600	0.0000	0.7700		14.5070 (75)	
Southeast					2.4700	36.7938	0.4600	0.0000	0.7700		32.1900 (77)	
Southwest					4.6800	36.7938	0.4600	0.0000	0.7700		60.9915 (79)	
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700		43.3978 (79)	
Solar gains	151.0863	262.1745	371.5177	481.7818	559.2174	563.7868	539.9662	480.8789	409.4962	293.2096	181.8441	128.7306 (83)
Total gains	494.6046	604.3564	701.7603	792.3709	849.0487	834.2626	798.2831	743.0137	682.0929	585.5953	496.9975	461.7315 (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	33.3617	33.4594	33.5557	34.0155	34.1029	34.5159	34.5159	34.5935	34.3557	34.1029	33.9265	33.7440	
alpha	3.2241	3.2306	3.2370	3.2677	3.2735	3.3011	3.3011	3.3062	3.2904	3.2735	3.2618	3.2496	
util living area	0.9855	0.9722	0.9461	0.8893	0.7877	0.6379	0.4947	0.5432	0.7557	0.9211	0.9755	0.9883	(86)
MIT	19.0327	19.3084	19.7103	20.2025	20.6070	20.8641	20.9562	20.9400	20.7489	20.2056	19.5269	18.9878	(87)
Th 2	19.8951	19.8980	19.9008	19.9140	19.9164	19.9280	19.9280	19.9301	19.9235	19.9164	19.9114	19.9062	(88)
util rest of house	0.9825	0.9664	0.9346	0.8650	0.7401	0.5575	0.3868	0.4344	0.6859	0.8985	0.9694	0.9858	(89)
MIT 2	18.1099	18.3843	18.7804	19.2628	19.6331	19.8525	19.9120	19.9063	19.7676	19.2780	18.6131	18.0735	(90)
Living area fraction	18.3411	18.6158	19.0133	19.4982	19.8771	20.1059	20.1736	20.1653	20.0134	19.5104	18.8420	18.3025	(91)
MIT	18.3411	18.6158	19.0133	19.4982	19.8771	20.1059	20.1736	20.1653	20.0134	19.5104	18.8420	18.3025	(92)
Temperature adjustment	18.3411	18.6158	19.0133	19.4982	19.8771	20.1059	20.1736	20.1653	20.0134	19.5104	18.8420	18.3025	(93)
adjusted MIT	18.3411	18.6158	19.0133	19.4982	19.8771	20.1059	20.1736	20.1653	20.0134	19.5104	18.8420	18.3025	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	483.0377	578.7340	647.7823	676.7122	626.7867	477.0326	329.4041	341.5643	472.3084	520.0781	477.8287	452.8696	(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	1388.5419	1352.4120	1230.3090	1027.9277	791.0661	526.2767	341.5771	359.0938	567.8692	862.0055	1141.8527	1378.8176	(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	673.6952	519.9117	433.3998	252.8751	122.2239	0.0000	0.0000	0.0000	0.0000	254.3940	478.0973	688.9053	(98)
Space heating												3423.5023	(98)
Space heating per m2												42.6233	(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	898.4933	707.3245	724.8122	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8288	0.8854	0.8623	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	744.6340	626.2404	624.9940	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1067.3786	1023.4329	960.4375	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	232.3761	295.5112	249.5700	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			777.4573 (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	58.0940	73.8778	62.3925	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												194.3643 (107)
Energy for space heating												2.4199 (108)
Energy for space cooling												42.6233 (99)
Total												2.4199 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.0432 (109)
												45.0 (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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) =	0.1445 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3945 (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) =					0.3649 (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	0.4653	0.4561	0.4470	0.4014	0.3923	0.3467	0.3467	0.3375	0.3649	0.3923	0.4105	0.4288	(22b)				
Effective ac	0.6082	0.6040	0.5999	0.5806	0.5769	0.5601	0.5601	0.5570	0.5666	0.5769	0.5843	0.5919	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			14.1100	1.3258	18.7064		(27)					
GF B&B J150 P/A=0.40			40.1600	0.1300	5.2208		(28a)					
EW Brick AAC015	92.7000	16.2400	76.4600	0.1800	13.7628		(29a)					
Plane Ceiling	40.1600		40.1600	0.1300	5.2208		(30)					
Total net area of external elements Aum(A, m2)			173.0200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0408		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8721 (36)					
Total fabric heat loss						(33) + (36) =	54.9129 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.6740	Feb 41.3861	Mar 41.1038	Apr 39.7781	May 39.5301	Jun 38.3754	Jul 38.3754	Aug 38.1616	Sep 38.8201	Oct 39.5301	Nov 40.0318	Dec 40.5564 (38)
Heat transfer coeff	96.5870	96.2990	96.0168	94.6910	94.4430	93.2883	93.2883	93.0745	93.7331	94.4430	94.9448	95.4694 (39)
Average = Sum(39)m / 12 =												94.6899 (39)
HLP	Jan 1.2025	Feb 1.1989	Mar 1.1954	Apr 1.1789	May 1.1758	Jun 1.1615	Jul 1.1615	Aug 1.1588	Sep 1.1670	Oct 1.1758	Nov 1.1821	Dec 1.1886 (40)
HLP (average)												1.1789 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
Daily hot water use	Jan 102.1201	Feb 98.4067	Mar 94.6932	Apr 90.9798	May 87.2663	Jun 83.5528	Jul 83.5528	Aug 87.2663	Sep 90.9798	Oct 94.6932	Nov 98.4067	Dec 102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (45)
Energy content (annual)										Total = Sum(45)m =		1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658 (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	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1223	17.8724	14.5348	11.0038	8.2255	6.9443	7.5036	9.7534	13.0910	16.6220	19.4004	20.6815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains	343.5183	342.1819	330.2425	310.5891	289.8313	270.4758	258.3169	262.1348	272.5967	292.3856	315.1535	333.0010	(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				3.6300	11.2829	0.6300	0.7000			0.7700			12.5170 (75)
Southeast				2.4700	36.7938	0.6300	0.7000			0.7700			27.7743 (77)
Southwest				8.0100	36.7938	0.6300	0.7000			0.7700			90.0698 (79)
Solar gains	130.3612	226.2110	320.5552	415.6939	482.5074	486.4499	465.8969	414.9149	353.3240	252.9889	156.8998	111.0721	(83)
Total gains	473.8795	568.3929	650.7977	726.2830	772.3387	756.9258	724.2138	677.0496	625.9207	545.3746	472.0533	444.0730	(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	57.7488	57.9214	58.0917	58.9050	59.0597	59.7907	59.7907	59.9281	59.5070	59.0597	58.7476	58.4248	
alpha	4.8499	4.8614	4.8728	4.9270	4.9373	4.9860	4.9860	4.9952	4.9671	4.9373	4.9165	4.8950	
util living area	0.9981	0.9952	0.9868	0.9585	0.8802	0.7215	0.5518	0.6072	0.8457	0.9749	0.9959	0.9987	(86)
MIT	19.6797	19.8587	20.1302	20.4770	20.7690	20.9406	20.9873	20.9801	20.8632	20.4757	20.0123	19.6526	(87)
Th 2	19.9180	19.9208	19.9237	19.9369	19.9394	19.9510	19.9510	19.9531	19.9465	19.9394	19.9344	19.9291	(88)
util rest of house	0.9975	0.9935	0.9819	0.9426	0.8347	0.6288	0.4279	0.4814	0.7727	0.9623	0.9942	0.9982	(89)
MIT 2	18.7183	18.8989	19.1700	19.5176	19.7840	19.9238	19.9478	19.9475	19.8715	19.5236	19.0634	18.7002	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.9591	19.1393	19.4106	19.7579	20.0308	20.1785	20.2082	20.2062	20.1199	19.7621	19.3011	18.9388	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9591	19.1393	19.4106	19.7579	20.0308	20.1785	20.2082	20.2062	20.1199	19.7621	19.3011	18.9388	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9919	0.9790	0.9393	0.8392	0.6504	0.4593	0.5132	0.7865	0.9595	0.9928	0.9976	(94)
Ext temp.	472.3165	563.7654	637.1046	682.1928	648.1330	492.3151	332.6127	347.4740	492.2932	523.3069	468.6493	442.9978	(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	1415.8817	1371.2335	1239.6298	1028.1464	786.7813	520.4104	336.6028	354.2582	564.2625	865.2976	1158.4300	1407.1044	(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	(98)
Space heating kWh	702.0126	542.6186	448.2787	249.0866	103.1543	0.0000	0.0000	0.0000	0.0000	254.4411	496.6422	717.2953	(98)
Space heating												3513.5293	(98)
Space heating per m2												43.7441	(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	876.9103	690.3336	707.3662	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8745	0.9316	0.9108	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	766.8893	643.1130	644.2529	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	976.9849	936.8584	883.3367	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	151.2689	218.5466	177.8783	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												547.6938	(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	37.8172	54.6366	44.4696	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												136.9234 (107)
Space cooling per m2												1.7047 (108)
Energy for space heating												43.7441 (99)
Energy for space cooling												1.7047 (108)
Total												45.4489 (109)
Target Fabric Energy Efficiency (TFEE)												52.3 (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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.3836	0.3654	0.3654	0.3380	0.3380	0.3014	0.3106	0.2923	0.3014	0.3197	0.3197	0.3471 (22b)
Effective ac	0.5736	0.5667	0.5667	0.5571	0.5571	0.5454	0.5482	0.5427	0.5454	0.5511	0.5511	0.5602 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11877.0680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 147.8719 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.6335 (36)
Total fabric heat loss (33) + (36) = 57.1986 (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	39.3005	38.8317	38.8317	38.1715	38.1715	37.3711	37.5626	37.1854	37.3711	37.7599	37.7599	38.3858 (38)
Heat transfer coeff	96.4990	96.0303	96.0303	95.3700	95.3700	94.5697	94.7612	94.3839	94.5697	94.9584	94.9584	95.5844 (39)
Average = Sum(39)m / 12 =												95.2571 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1956	1.1956	1.1874	1.1874	1.1774	1.1798	1.1751	1.1774	1.1823	1.1823	1.1900 (40)
HLP (average)												1.1860 (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 2.4689 (42)
Average daily hot water use (litres/day) 92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 = 1460.6794 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994 (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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570 (61)
Total heat required for water heating calculated for each month											
166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (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											
166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296 (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	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3057	44.6811	36.3371	27.5095	20.5637	17.3607	18.7589	24.3835	32.7275	41.5551	48.5009	51.7039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	556.0958	551.7285	530.3257	497.1380	463.1635	432.7140	414.9040	423.1622	442.2466	475.6463	512.7738	540.8585	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF		Access factor Table 6d	Gains W
Northeast				3.6300	12.9236		0.4600		0.0000		0.7700	16.6164 (75)
Southeast				2.4700	40.4699		0.4600		0.0000		0.7700	35.4061 (77)
Southwest				4.6800	40.4699		0.4600		0.0000		0.7700	67.0852 (79)
Southwest				3.3300	40.4699		0.4600		0.0000		0.7700	47.7337 (79)
Solar gains	166.8414	260.7910	366.2769	492.2460	559.2267	604.5034	572.2436	519.2469	438.5231	311.7140	205.7633	140.7640 (83)
Total gains	722.9372	812.5195	896.6026	989.3840	1022.3902	1037.2174	987.1476	942.4091	880.7697	787.3603	718.5371	681.6225 (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	34.1888	34.3557	34.3557	34.5935	34.5935	34.8863	34.8158	34.9550	34.8863	34.7435	34.7435	34.5159
alpha	3.2793	3.2904	3.2904	3.3062	3.3062	3.3258	3.3211	3.3303	3.3258	3.3162	3.3162	3.3011
util living area	0.9533	0.9320	0.8865	0.7930	0.6458	0.4371	0.2938	0.3155	0.5669	0.8140	0.9231	0.9596 (86)
MIT	19.5603	19.7689	20.1278	20.5315	20.8245	20.9665	20.9937	20.9920	20.9157	20.5690	20.0221	19.5209 (87)
Th 2	19.9189	19.9235	19.9235	19.9301	19.9301	19.9381	19.9362	19.9400	19.9381	19.9342	19.9342	19.9280 (88)
util rest of house	0.9442	0.9191	0.8648	0.7547	0.5827	0.3513	0.1948	0.2133	0.4808	0.7703	0.9061	0.9516 (89)
MIT 2	18.0541	18.3526	18.8560	19.4044	19.7669	19.9180	19.9345	19.9376	19.8764	19.4705	18.7250	18.0043 (90)
Living area fraction									fLA = Living area / (4) =			0.2505 (91)
MIT	18.4314	18.7074	19.1746	19.6868	20.0318	20.1807	20.1998	20.2017	20.1367	19.7457	19.0499	18.3842 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2814	18.5574	19.0246	19.5368	19.8818	20.0307	20.0498	20.0517	19.9867	19.5957	18.8999	18.2342 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9257	0.8983	0.8430	0.7387	0.5796	0.3591	0.2055	0.2243	0.4850	0.7542	0.8851	0.9344 (94)
Useful gains	669.2227	729.8761	755.8384	730.8733	592.5924	372.4259	202.8602	211.3709	427.2012	593.7988	635.9499	636.9016 (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	1271.9928	1244.3016	1116.3099	919.0584	656.3155	381.1777	203.7172	212.5270	452.6811	759.2584	1035.0416	1255.4284 (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	448.4609	345.6940	268.1908	135.4933	47.4099	0.0000	0.0000	0.0000	0.0000	123.1020	287.3461	460.1839 (98)
Space heating												2115.8807 (98)
RHI space heating demand												2116 (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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.4658	0.4567	0.4476	0.4019	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4110	0.4293 (22b)
	0.6085	0.6043	0.6002	0.5808	0.5771	0.5602	0.5602	0.5571	0.5667	0.5771	0.5845	0.5922 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11877.0680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.8719 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6335 (36)
Total fabric heat loss							(33) + (36) = 57.1986 (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	41.6928	41.4042	41.1212	39.7921	39.5434	38.3858	38.3858	38.1715	38.8317	39.5434	40.0465	40.5724 (38)
Heat transfer coeff	98.8914	98.6027	98.3198	96.9907	96.7420	95.5844	95.5844	95.3700	96.0303	96.7420	97.2450	97.7710 (39)
Average = Sum(39)m / 12 =												96.9895 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2312	1.2276	1.2241	1.2076	1.2045	1.1900	1.1900	1.1874	1.1956	1.2045	1.2107	1.2173 (40)
HLP (average)												1.2075 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 = 1460.6794 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994 (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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570 (61)
Total heat required for water heating calculated for each month											
166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (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											
166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (64)
Heat gains from water heating, kWh/month											
54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296 (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	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3057	44.6811	36.3371	27.5095	20.5637	17.3607	18.7589	24.3835	32.7275	41.5551	48.5009	51.7039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	556.0958	551.7285	530.3257	497.1380	463.1635	432.7140	414.9040	423.1622	442.2466	475.6463	512.7738	540.8585	(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					3.6300	11.2829	0.4600	0.0000	0.7700		14.5070 (75)	
Southeast					2.4700	36.7938	0.4600	0.0000	0.7700		32.1900 (77)	
Southwest					4.6800	36.7938	0.4600	0.0000	0.7700		60.9915 (79)	
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700		43.3978 (79)	
Solar gains	151.0863	262.1745	371.5177	481.7818	559.2174	563.7868	539.9662	480.8789	409.4962	293.2096	181.8441	128.7306 (83)
Total gains	707.1821	813.9030	901.8434	978.9199	1022.3809	996.5008	954.8701	904.0411	851.7428	768.8559	694.6179	669.5890 (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	33.3617	33.4594	33.5557	34.0155	34.1029	34.5159	34.5159	34.5935	34.3557	34.1029	33.9265	33.7440
alpha	3.2241	3.2306	3.2370	3.2677	3.2735	3.3011	3.3011	3.3062	3.2904	3.2735	3.2618	3.2496
util living area	0.9618	0.9402	0.9026	0.8298	0.7149	0.5599	0.4235	0.4613	0.6633	0.8569	0.9411	0.9672 (86)
MIT	19.3584	19.6089	19.9643	20.3856	20.7127	20.9081	20.9723	20.9630	20.8334	20.4089	19.8140	19.3123 (87)
Th 2	19.8951	19.8980	19.9008	19.9140	19.9164	19.9280	19.9280	19.9301	19.9235	19.9164	19.9114	19.9062 (88)
util rest of house	0.9545	0.9290	0.8843	0.7979	0.6623	0.4822	0.3272	0.3634	0.5890	0.8228	0.9282	0.9608 (89)
MIT 2	17.7484	18.1073	18.6110	19.1988	19.6229	19.8560	19.9137	19.9096	19.7796	19.2467	18.4155	17.6895 (90)
Living area fraction	18.1517	18.4834	18.9500	19.4961	19.8959	20.1196	20.1789	20.1735	20.0436	19.5378	18.7658	18.0960 (91)
MIT	18.0017	18.3334	18.8000	19.3461	19.7459	19.9696	20.0289	20.0235	19.8936	19.3878	18.6158	17.9460 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0017	18.3334	18.8000	19.3461	19.7459	19.9696	20.0289	20.0235	19.8936	19.3878	18.6158	17.9460 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9372	0.9084	0.8618	0.7787	0.6532	0.4854	0.3366	0.3723	0.5867	0.8029	0.9080	0.9450	(94)
Useful gains	662.7875	739.3374	777.1654	762.2581	667.8101	483.6936	321.3790	336.5473	499.7320	617.3394	630.7226	632.7629	(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	1354.9803	1324.5748	1209.3338	1013.1711	778.3736	513.2461	327.7518	345.5728	556.3619	850.1521	1119.8543	1343.9572	(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	514.9915	393.2795	321.5332	180.6574	82.2593	0.0000	0.0000	0.0000	0.0000	173.2127	352.1748	529.1286	(98)
Space heating												2547.2369	(98)
Space heating per m2												(98) / (4) = 31.7136	(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													2814.6264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	514.9915	393.2795	321.5332	180.6574	82.2593	0.0000	0.0000	0.0000	0.0000	173.2127	352.1748	529.1286	(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)	569.0513	434.5630	355.2853	199.6214	90.8942	0.0000	0.0000	0.0000	0.0000	191.3952	389.1434	584.6724	(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	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196	(64)
Efficiency of water heater (217)m	89.6981	89.6121	89.4509	89.1135	88.5196	87.3000	87.3000	87.3000	87.3000	89.0509	89.5234	87.3000	(216)
Fuel for water heating, kWh/month	185.1905	162.5713	169.1243	149.5203	145.5637	129.0595	121.2740	136.7748	137.7020	155.2982	166.6755	179.7803	(219)
Water heating fuel used												1838.5345	(219)
Annual totals kWh/year													
Space heating fuel - main system												2814.6264	(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)												355.3658	(232)
Total delivered energy for all uses												5083.5267	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2814.6264	3.4800	97.9490 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1838.5345	3.4800	63.9810 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	355.3658	13.1900	46.8727 (250)
Additional standing charges			120.0000 (251)
Total energy cost			338.6952 (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] =	1.1351 (257)
SAP value		84.1652
SAP rating (Section 12)		84 (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	2814.6264	0.2160	607.9593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1838.5345	0.2160	397.1235 (264)
Space and water heating			1005.0828 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1228.4426 (272)
CO2 emissions per m2			15.2900 (273)
EI value			86.8647
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	$3.48 / 0.8866 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8866 = 0.2436$, 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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =		0.3654 (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	0.3836	0.3654	0.3654	0.3380	0.3380	0.3014	0.3106	0.2923	0.3014	0.3197	0.3197	0.3471 (22b)
Effective ac	0.5736	0.5667	0.5667	0.5571	0.5571	0.5454	0.5482	0.5427	0.5454	0.5511	0.5511	0.5602 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (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) = 11877.0680 (34)
147.8719 (35)
6.6335 (36)
(33) + (36) = 57.1986 (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	39.3005	38.8317	38.8317	38.1715	38.1715	37.3711	37.5626	37.1854	37.3711	37.7599	37.7599	38.3858 (38)
Heat transfer coeff	96.4990	96.0303	96.0303	95.3700	95.3700	94.5697	94.7612	94.3839	94.5697	94.9584	94.9584	95.5844 (39)
Average = Sum(39)m / 12 =												95.2571 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1956	1.1956	1.1874	1.1874	1.1774	1.1798	1.1751	1.1774	1.1823	1.1823	1.1900 (40)
HLP (average)												1.1860 (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)
2.4689 (42)
92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 =	1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570	14.6569	(61)
Total heat required for water heating calculated for each month	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196	(64)
Total per year (kWh/year) = Sum(64)m =												1632.1614	(64)
Heat gains from water heating, kWh/month	54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296	(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	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3057	44.6811	36.3371	27.5095	20.5637	17.3607	18.7589	24.3835	32.7275	41.5551	48.5009	51.7039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	556.0958	551.7285	530.3257	497.1380	463.1635	432.7140	414.9040	423.1622	442.2466	475.6463	512.7738	540.8585	(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					3.6300	12.9236	0.4600	0.0000	0.7700		16.6164 (75)	
Southeast					2.4700	40.4699	0.4600	0.0000	0.7700		35.4061 (77)	
Southwest					4.6800	40.4699	0.4600	0.0000	0.7700		67.0852 (79)	
Southwest					3.3300	40.4699	0.4600	0.0000	0.7700		47.7337 (79)	
Solar gains	166.8414	260.7910	366.2769	492.2460	559.2267	604.5034	572.2436	519.2469	438.5231	311.7140	205.7633	140.7640 (83)
Total gains	722.9372	812.5195	896.6026	989.3840	1022.3902	1037.2174	987.1476	942.4091	880.7697	787.3603	718.5371	681.6225 (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	34.1888	34.3557	34.3557	34.5935	34.5935	34.8863	34.8158	34.9550	34.8863	34.7435	34.7435	34.5159	
alpha	3.2793	3.2904	3.2904	3.3062	3.3062	3.3258	3.3211	3.3303	3.3258	3.3162	3.3162	3.3011	
util living area	0.9533	0.9320	0.8865	0.7930	0.6458	0.4371	0.2938	0.3155	0.5669	0.8140	0.9231	0.9596	(86)
MIT	19.5603	19.7689	20.1278	20.5315	20.8245	20.9665	20.9937	20.9920	20.9157	20.5690	20.0221	19.5209	(87)
Th 2	19.9189	19.9235	19.9235	19.9301	19.9301	19.9381	19.9362	19.9400	19.9381	19.9342	19.9342	19.9280	(88)
util rest of house	0.9442	0.9191	0.8648	0.7547	0.5827	0.3513	0.1948	0.2133	0.4808	0.7703	0.9061	0.9516	(89)
MIT 2	18.0541	18.3526	18.8560	19.4044	19.7669	19.9180	19.9345	19.9376	19.8764	19.4705	18.7250	18.0043	(90)
Living area fraction	18.4314	18.7074	19.1746	19.6868	20.0318	20.1807	20.1998	20.2017	20.1367	19.7457	19.0499	18.3842	(92)
MIT	18.4314	18.7074	19.1746	19.6868	20.0318	20.1807	20.1998	20.2017	20.1367	19.7457	19.0499	18.3842	(92)
Temperature adjustment	18.2814	18.5574	19.0246	19.5368	19.8818	20.0307	20.0498	20.0517	19.9867	19.5957	18.8999	18.2342	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.8983	0.8430	0.7387	0.5796	0.3591	0.2055	0.2243	0.4850	0.7542	0.8851	0.9344	(94)
Useful gains	669.2227	729.8761	755.8384	730.8733	592.5924	372.4259	202.8602	211.3709	427.2012	593.7988	635.9499	636.9016	(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	1271.9928	1244.3016	1116.3099	919.0584	656.3155	381.1777	203.7172	212.5270	452.6811	759.2584	1035.0416	1255.4284	(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	448.4609	345.6940	268.1908	135.4933	47.4099	0.0000	0.0000	0.0000	0.0000	123.1020	287.3461	460.1839	(98)
Space heating												2115.8807	(98)
Space heating per m2												(98) / (4) =	26.3431 (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													2337.9898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.4609	345.6940	268.1908	135.4933	47.4099	0.0000	0.0000	0.0000	0.0000	123.1020	287.3461	460.1839	(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)	495.5369	381.9823	296.3434	149.7163	52.3867	0.0000	0.0000	0.0000	0.0000	136.0243	317.5095	508.4905	(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	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196	(64)
Efficiency of water heater (217)m	89.6122	89.5271	89.3192	88.8846	88.1383	87.3000	87.3000	87.3000	87.3000	88.7783	89.3802	87.3000	(216)
Fuel for water heating, kWh/month	185.3682	162.7257	169.3736	149.9053	146.1934	129.0595	121.2740	136.7748	137.7020	155.7749	166.9426	179.9497	(219)
Water heating fuel used												1841.0438	(219)
Annual totals kWh/year													
Space heating fuel - main system												2337.9898	(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)												355.3658	(232)
Total delivered energy for all uses												4609.3994	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2337.9898	9.7400	227.7202 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1841.0438	9.7400	179.3177 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	355.3658	36.8500	130.9523 (250)
Additional standing charges			104.0000 (251)
Total energy cost			669.6277 (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	2337.9898	0.2160	505.0058 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1841.0438	0.2160	397.6655 (264)
Space and water heating			902.6713 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1126.0311 (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	2337.9898	1.2200	2852.3475 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1841.0438	1.2200	2246.0735 (264)
Space and water heating			5098.4210 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	355.3658	3.0700	1090.9729 (268)
Primary energy kWh/year			6419.6439 (272)
Primary energy kWh/m2/year			79.9258 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
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	-£ 75	-182 kg (16.2%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (100.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£75	2.27 kg/m ²	B 85 B 89
Solar photovoltaic panels	£672	11.79 kg/m ²	A 96 A 98
Total Savings	£748	14.05 kg/m ²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 98

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	£159	£177	-£18
Mains gas	£511	£417	£94
Space heating	£359	£359	£0
Water heating	£179	£104	£75
Lighting	£131	£131	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£670	-£78	£748
Total cost of uses	£669	-£78	£747
Delivered energy	57 kWh/m ²	23 kWh/m ²	34 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m ²	14 kg/m ²	0 kg/m ²	14 kg/m ²
Primary energy	80 kWh/m ²	-3 kWh/m ²	82 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.4658	0.4567	0.4476	0.4019	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4110	0.4293 (22b)
	0.6085	0.6043	0.6002	0.5808	0.5771	0.5602	0.5602	0.5571	0.5667	0.5771	0.5845	0.5922 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11877.0680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.8719 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6335 (36)
Total fabric heat loss							(33) + (36) = 57.1986 (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	41.6928	41.4042	41.1212	39.7921	39.5434	38.3858	38.3858	38.1715	38.8317	39.5434	40.0465	40.5724 (38)
Heat transfer coeff	98.8914	98.6027	98.3198	96.9907	96.7420	95.5844	95.5844	95.3700	96.0303	96.7420	97.2450	97.7710 (39)
Average = Sum(39)m / 12 =												96.9895 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2312	1.2276	1.2241	1.2076	1.2045	1.1900	1.1900	1.1874	1.1956	1.2045	1.2107	1.2173 (40)
HLP (average)												1.2075 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 = 1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994 (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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570	14.6569 (61)
Total heat required for water heating calculated for each month	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196 (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												1.2416 (H8)
Utilisation factor												0.5531 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-844.3736 (H17)
Solar input												-844.3736 (63)
Output from w/h	141.6273	104.8249	81.6962	39.9825	13.6371	0.0000	0.0000	21.7434	43.7257	86.0620	120.1707	140.8297 (64)
Heat gains from water heating, kWh/month	54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296 (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	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3057	44.6811	36.3371	27.5095	20.5637	17.3607	18.7589	24.3835	32.7275	41.5551	48.5009	51.7039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(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)	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	556.0958	551.7285	530.3257	497.1380	463.1635	432.7140	414.9040	423.1622	442.2466	475.6463	512.7738	540.8585	(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				3.6300	11.2829	0.4600		0.0000		0.7700		14.5070 (75)
Southeast				2.4700	36.7938	0.4600		0.0000		0.7700		32.1900 (77)
Southwest				4.6800	36.7938	0.4600		0.0000		0.7700		60.9915 (79)
Southwest				3.3300	36.7938	0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	151.0863	262.1745	371.5177	481.7818	559.2174	563.7868	539.9662	480.8789	409.4962	293.2096	181.8441	128.7306 (83)
Total gains	707.1821	813.9030	901.8434	978.9199	1022.3809	996.5008	954.8701	904.0411	851.7428	768.8559	694.6179	669.5890 (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	33.3617	33.4594	33.5557	34.0155	34.1029	34.5159	34.5159	34.5935	34.3557	34.1029	33.9265	33.7440
alpha	3.2241	3.2306	3.2370	3.2677	3.2735	3.3011	3.3011	3.3062	3.2904	3.2735	3.2618	3.2496
util living area	0.9618	0.9402	0.9026	0.8298	0.7149	0.5599	0.4235	0.4613	0.6633	0.8569	0.9411	0.9672 (86)
MIT	19.3584	19.6089	19.9643	20.3856	20.7127	20.9081	20.9723	20.9630	20.8334	20.4089	19.8140	19.3123 (87)
Th 2	19.8951	19.8980	19.9008	19.9140	19.9164	19.9280	19.9280	19.9301	19.9235	19.9164	19.9114	19.9062 (88)
util rest of house	0.9545	0.9290	0.8843	0.7979	0.6623	0.4822	0.3272	0.3634	0.5890	0.8228	0.9282	0.9608 (89)
MIT 2	17.7484	18.1073	18.6110	19.1988	19.6229	19.8560	19.9137	19.9096	19.7796	19.2467	18.4155	17.6895 (90)
Living area fraction	18.1517	18.4834	18.9500	19.4961	19.8959	20.1196	20.1789	20.1735	20.0436	19.5378	18.7658	18.0960 (92)
MIT	18.0017	18.3334	18.8000	19.3461	19.7459	19.9696	20.0289	20.0235	19.8936	19.3878	18.6158	17.9460 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9372	0.9084	0.8618	0.7787	0.6532	0.4854	0.3366	0.3723	0.5867	0.8029	0.9080	0.9450	(94)
Useful gains	662.7875	739.3374	777.1654	762.2581	667.8101	483.6936	321.3790	336.5473	499.7320	617.3394	630.7226	632.7629	(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	1354.9803	1324.5748	1209.3338	1013.1711	778.3736	513.2461	327.7518	345.5728	556.3619	850.1521	1119.8543	1343.9572	(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	514.9915	393.2795	321.5332	180.6574	82.2593	0.0000	0.0000	0.0000	0.0000	173.2127	352.1748	529.1286	(98)
Space heating												2547.2369	(98)
Space heating per m2											(98) / (4) =	31.7136	(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													2814.6264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	514.9915	393.2795	321.5332	180.6574	82.2593	0.0000	0.0000	0.0000	0.0000	173.2127	352.1748	529.1286	(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)	569.0513	434.5630	355.2853	199.6214	90.8942	0.0000	0.0000	0.0000	0.0000	191.3952	389.1434	584.6724	(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	141.6273	104.8249	81.6962	39.9825	13.6371	0.0000	0.0000	21.7434	43.7257	86.0620	120.1707	140.8297	(64)
Efficiency of water heater	(217)m	89.7901	89.8329	89.9028	90.0307	87.3000	87.3000	87.3000	87.3000	89.4121	89.6638	87.3000	(216)
Fuel for water heating, kWh/month	157.7315	116.7221	90.9425	44.4730	15.1472	0.0000	0.0000	24.9065	50.0868	96.2532	134.0236	156.8120	(219)
Water heating fuel used												887.0983	(219)
Annual totals kWh/year													
Space heating fuel - main system												2814.6264	(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)													355.3658 (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												2454.8511	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2814.6264	3.4800	97.9490	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	887.0983	3.4800	30.8710	(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	355.3658	13.1900	46.8727	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			84.3574	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.2827 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	96.0561
SAP rating (Section 12)			96 (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	2814.6264	0.2160	607.9593 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	887.0983	0.2160	191.6132 (264)
Space and water heating			799.5725 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			152.4451 (272)
CO2 emissions per m2			1.9000 (273)
EI value			98.3700
EI rating			98 (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	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6272 (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) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (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) =	0.3654 (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	0.3836	0.3654	0.3654	0.3380	0.3380	0.3014	0.3106	0.2923	0.3014	0.3197	0.3197	0.3471 (22b)
Effective ac	0.5736	0.5667	0.5667	0.5571	0.5571	0.5454	0.5482	0.5427	0.5454	0.5511	0.5511	0.5602 (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)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (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) = 11877.0680 (34)
 147.8719 (35)
 6.6335 (36)
 (33) + (36) = 57.1986 (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	39.3005	38.8317	38.8317	38.1715	38.1715	37.3711	37.5626	37.1854	37.3711	37.7599	37.7599	38.3858 (38)
Heat transfer coeff	96.4990	96.0303	96.0303	95.3700	95.3700	94.5697	94.7612	94.3839	94.5697	94.9584	94.9584	95.5844 (39)
Average = Sum(39)m / 12 =												95.2571 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2014	1.1956	1.1956	1.1874	1.1874	1.1774	1.1798	1.1751	1.1774	1.1823	1.1823	1.1900 (40)
HLP (average)												1.1860 (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												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (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 =	1460.6794 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(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	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	14.1570	14.6569	(61)
Total heat required for water heating calculated for each month													
	166.1124	145.6836	151.2832	133.2428	128.8524	112.6690	105.8722	119.4044	120.2139	138.2944	149.2136	161.3196	(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	-26.4781	-39.7965	-67.0223	-92.6454	-111.5762	-117.4291	-114.6094	-102.3469	-79.8821	-54.3423	-32.1848	-860.2505	(63)
Solar input (sum of months) = Sum (63)m =													
Output from w/h													
	139.6344	105.8871	84.2609	40.5974	17.2761	0.0000	0.0000	17.0575	40.3317	83.9521	117.0288	139.3824	(64)
Total per year (kWh/year) = Sum (64)m =													
Heat gains from water heating, kWh/month													
	54.0220	47.3481	49.0967	43.1413	41.6458	36.3070	34.0107	38.5064	38.8121	44.7810	48.4456	52.4296	(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	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3057	44.6811	36.3371	27.5095	20.5637	17.3607	18.7589	24.3835	32.7275	41.5551	48.5009	51.7039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(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)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	72.6102	70.4585	65.9902	59.9185	55.9756	50.4264	45.7133	51.7559	53.9058	60.1895	67.2855	70.4699	(72)
Total internal gains	556.0958	551.7285	530.3257	497.1380	463.1635	432.7140	414.9040	423.1622	442.2466	475.6463	512.7738	540.8585	(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					3.6300	12.9236	0.4600	0.0000			0.7700			16.6164 (75)
Southeast					2.4700	40.4699	0.4600	0.0000			0.7700			35.4061 (77)
Southwest					4.6800	40.4699	0.4600	0.0000			0.7700			67.0852 (79)
Southwest					3.3300	40.4699	0.4600	0.0000			0.7700			47.7337 (79)

Solar gains	166.8414	260.7910	366.2769	492.2460	559.2267	604.5034	572.2436	519.2469	438.5231	311.7140	205.7633			140.7640 (83)
Total gains	722.9372	812.5195	896.6026	989.3840	1022.3902	1037.2174	987.1476	942.4091	880.7697	787.3603	718.5371			681.6225 (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	34.1888	34.3557	34.3557	34.5935	34.5935	34.8863	34.8158	34.9550	34.8863	34.7435	34.7435	34.5159	
alpha	3.2793	3.2904	3.2904	3.3062	3.3062	3.3258	3.3211	3.3303	3.3258	3.3162	3.3162	3.3011	
util living area	0.9533	0.9320	0.8865	0.7930	0.6458	0.4371	0.2938	0.3155	0.5669	0.8140	0.9231	0.9596	(86)
MIT	19.5603	19.7689	20.1278	20.5315	20.8245	20.9665	20.9937	20.9920	20.9157	20.5690	20.0221	19.5209	(87)
Th 2	19.9189	19.9235	19.9235	19.9301	19.9301	19.9381	19.9362	19.9400	19.9381	19.9342	19.9342	19.9280	(88)
util rest of house	0.9442	0.9191	0.8648	0.7547	0.5827	0.3513	0.1948	0.2133	0.4808	0.7703	0.9061	0.9516	(89)
MIT 2	18.0541	18.3526	18.8560	19.4044	19.7669	19.9180	19.9345	19.9376	19.8764	19.4705	18.7250	18.0043	(90)
Living area fraction													
MIT	18.4314	18.7074	19.1746	19.6868	20.0318	20.1807	20.1998	20.2017	20.1367	19.7457	19.0499	18.3842	(92)
Temperature adjustment													
adjusted MIT	18.2814	18.5574	19.0246	19.5368	19.8818	20.0307	20.0498	20.0517	19.9867	19.5957	18.8999	18.2342	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9257	0.8983	0.8430	0.7387	0.5796	0.3591	0.2055	0.2243	0.4850	0.7542	0.8851	0.9344	(94)
Useful gains	669.2227	729.8761	755.8384	730.8733	592.5924	372.4259	202.8602	211.3709	427.2012	593.7988	635.9499	636.9016	(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	1271.9928	1244.3016	1116.3099	919.0584	656.3155	381.1777	203.7172	212.5270	452.6811	759.2584	1035.0416	1255.4284	(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	448.4609	345.6940	268.1908	135.4933	47.4099	0.0000	0.0000	0.0000	0.0000	123.1020	287.3461	460.1839	(98)
Space heating												2115.8807	(98)
Space heating per m2											(98) / (4) =	26.3431	(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													2337.9898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.4609	345.6940	268.1908	135.4933	47.4099	0.0000	0.0000	0.0000	0.0000	123.1020	287.3461	460.1839	(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)	495.5369	381.9823	296.3434	149.7163	52.3867	0.0000	0.0000	0.0000	0.0000	136.0243	317.5095	508.4905	(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	139.6344	105.8871	84.2609	40.5974	17.2761	0.0000	0.0000	17.0575	40.3317	83.9521	117.0288	139.3824	(64)
Efficiency of water heater	89.7192	89.7288	89.7138	89.7416	89.6226	87.3000	87.3000	87.3000	87.3000	89.1747	89.5500	87.3000	(216)
(217)m	89.7192	89.7288	89.7138	89.7416	89.6226	87.3000	87.3000	87.3000	87.3000	89.1747	89.5500	87.3000	(217)
Fuel for water heating, kWh/month	155.6350	118.0079	93.9218	45.2380	19.2765	0.0000	0.0000	19.5389	46.1990	94.1434	130.6854	155.3261	(219)
Water heating fuel used												877.9721	(219)
Annual totals kWh/year													
Space heating fuel - main system												2337.9898	(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)												355.3658	(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												1872.1680	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2337.9898	9.7400	227.7202	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	877.9721	9.7400	85.5145	(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	355.3658	36.8500	130.9523	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			-77.9534	(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	2337.9898	0.2160	505.0058	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	877.9721	0.2160	189.6420	(264)
Space and water heating			694.6478	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.3658	0.5190	184.4348	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-2.7813 (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	2337.9898	1.2200	2852.3475 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	877.9721	1.2200	1071.1260 (264)
Space and water heating			3923.4735 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	355.3658	3.0700	1090.9729 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-201.9737 (272)
Primary energy kWh/m2/year			-2.5146 (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	147.9 (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	274.07 (P1)
Transmission heat loss coefficient	57.20 (37)
Summer heat loss coefficient	331.27 (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	3.6300	98.8453	0.4600	0.0000	0.9000	148.5466
South East	2.4700	119.9223	0.4600	0.0000	0.9000	122.6302
South West	4.6800	119.9223	0.4600	0.0000	0.9000	232.3519
South West	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273

total: 668.8561

	Jun	Jul	Aug	
Solar gains	707	669		(P4)
Internal gains	430	412		
Total summer gains	1136	1081	1027	(P5)

	3.43	3.26	3.10	
Summer gain/loss ratio				(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 147.9)	0.96	0.96	0.96	
Threshold temperature	20.39	22.13	21.87	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium