

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-575				Issued on Date	22/03/2023
Assessment Reference	Plot 575	Prop Type Ref	2-As-SEMI			
Property	Plot 575, 2 Bed, K, WC, B					
SAP Rating	84 B	DER	17.04	TER	18.69	
Environmental	87 B	% DER<TER	8.80			
CO ₂ Emissions (t/year)	1.14	DFEE	46.22	TFEE	53.74	
General Requirements Compliance	Pass	% DFEE<TFEE	14.00			
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) 18.69 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.04 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.2 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 West: 8.01 m², No overhang
Windows facing North West: 2.47 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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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)		
Southwest					4.6800	36.7938	0.4600	0.0000	0.7700	60.9915 (79)		
Northwest					2.4700	11.2829	0.4600	0.0000	0.7700	9.8712 (81)		
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)		
Solar gains	128.7675	227.4361	332.6962	448.2778	535.0143	545.6195	520.0119	453.0898	372.3742	257.1645	155.7084	109.2439 (83)
Total gains	504.6416	601.1927	692.8913	786.6169	851.1647	840.4023	800.9292	740.0155	670.5429	577.4012	501.2869	473.8252 (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	0.9847	0.9726	0.9478	0.8910	0.7868	0.6347	0.4934	0.5449	0.7623	0.9237	0.9749	0.9874 (86)
MIT	19.0487	19.3036	19.6981	20.1961	20.6085	20.8662	20.9566	20.9394	20.7416	20.1953	19.5335	19.0074 (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	0.9815	0.9669	0.9366	0.8670	0.7392	0.5543	0.3856	0.4360	0.6932	0.9017	0.9687	0.9848 (89)
MIT 2	17.3036	17.6741	18.2427	18.9518	19.5033	19.8193	19.9048	19.8949	19.6876	18.9675	18.0193	17.2503 (90)
Living area fraction	17.7407	18.0823	18.6073	19.2635	19.7801	20.0815	20.1682	20.1566	19.9516	19.2751	18.3986	17.6904 (91)
MIT	17.7407	18.0823	18.6073	19.2635	19.7801	20.0815	20.1682	20.1566	19.9516	19.2751	18.3986	17.6904 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5907	17.9323	18.4573	19.1135	19.6301	19.9315	20.0182	20.0066	19.8016	19.1251	18.2486	17.5404 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9714	0.9523	0.9170	0.8452	0.7248	0.5546	0.3952	0.4443	0.6842	0.8806	0.9549	0.9760	(94)
Useful gains	490.1893	572.5439	635.3815	664.8498	616.8985	466.0734	316.4887	328.7791	458.7622	508.4823	478.6719	462.4376	(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	1314.3401	1285.0158	1175.6343	990.6155	767.1762	509.6093	326.7309	343.9586	547.5284	824.7312	1084.1473	1304.3057	(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	613.1683	478.7811	401.9480	234.5513	111.8066	0.0000	0.0000	0.0000	0.0000	235.2892	435.9423	626.3499	(98)
Space heating												3137.8367	(98)
Space heating per m2												(98) / (4) = 39.0667	(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	3467.2229 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	613.1683	478.7811	401.9480	234.5513	111.8066	0.0000	0.0000	0.0000	0.0000	235.2892	435.9423	626.3499 (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)	677.5340	529.0399	444.1415	259.1727	123.5432	0.0000	0.0000	0.0000	0.0000	259.9880	481.7042	692.0994 (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	89.7984	89.7327	89.6019	89.3140	88.7581	87.3000	87.3000	87.3000	87.3000	89.2884	89.6619	87.3000 (216)
Fuel for water heating, kWh/month	184.9838	162.3529	168.8393	149.1847	145.1726	129.0595	121.2740	136.7748	137.7020	154.8850	166.4180	179.5919 (219)
Water heating fuel used	1836.2386 (219)											
Annual totals kWh/year												
Space heating fuel - main system	3467.2229 (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	5733.8272 (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	3467.2229	0.2160	748.9201 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1836.2386	0.2160	396.6275 (264)
Space and water heating			1145.5477 (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			1368.9075 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0400 (273)

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

DER		17.0400 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		35.4983 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		35.4983 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)		
	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												
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)
	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)
Output from w/h	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)
Heat gains from water heating, kWh/month	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)
Southwest			8.0100		36.7938		0.6300		0.7000		0.7700		90.0698 (79)
Northwest			2.4700		11.2829		0.6300		0.7000		0.7700		8.5171 (81)
Solar gains	111.1039	196.2378	287.0590	386.7858	461.6243	470.7747	448.6799	390.9377	321.2941	221.8882	134.3492	94.2585	(83)
Total gains	499.1715	581.9222	658.5609	735.8135	787.8398	775.0014	739.0499	687.9367	630.1639	553.4443	491.8626	471.0380	(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	0.9977	0.9947	0.9861	0.9565	0.8734	0.7094	0.5418	0.5990	0.8430	0.9734	0.9951	0.9982	(86)
MIT	19.7086	19.8740	20.1386	20.4859	20.7786	20.9449	20.9883	20.9812	20.8654	20.4839	20.0348	19.6837	(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	0.9969	0.9928	0.9811	0.9400	0.8264	0.6166	0.4196	0.4742	0.7695	0.9602	0.9931	0.9976	(89)
MIT 2	18.2032	18.4462	18.8319	19.3348	19.7227	19.9145	19.9467	19.9454	19.8387	19.3417	18.6913	18.1746	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.5803	18.8039	19.1592	19.6231	19.9872	20.1726	20.2076	20.2049	20.0959	19.6278	19.0278	18.5526	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5803	18.8039	19.1592	19.6231	19.9872	20.1726	20.2076	20.2049	20.0959	19.6278	19.0278	18.5526	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	496.8621	576.1520	642.9019	687.1480	652.9815	494.1282	332.8875	347.7897	492.4534	528.5362	487.2191	469.3749	(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	1379.2889	1338.9273	1215.4942	1015.3837	782.6713	519.8569	336.5495	354.1402	562.0135	852.6153	1132.4852	1370.2332	(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	656.5255	512.5850	426.0086	236.3297	96.4892	0.0000	0.0000	0.0000	0.0000	241.1149	464.5916	670.2386	(98)
Space heating												3303.8831	(98)
Space heating per m2										(98) / (4) =		41.1340	(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													3537.3481 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	656.5255	512.5850	426.0086	236.3297	96.4892	0.0000	0.0000	0.0000	0.0000	241.1149	464.5916	670.2386	(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)	702.9181	548.8062	456.1120	253.0296	103.3075	0.0000	0.0000	0.0000	0.0000	258.1530	497.4214	717.6002	(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	87.7978	87.5642	87.0844	85.9698	83.8403	80.3000	80.3000	80.3000	80.3000	85.9018	87.2903	80.3000	(216)
Fuel for water heating, kWh/month	230.5299	202.9887	212.3602	190.7947	189.4149	174.1812	166.8789	186.0308	188.0853	200.2060	210.3165	224.8692	(219)
Water heating fuel used												2376.6565	(219)
Annual totals kWh/year													
Space heating fuel - main system												3537.3481	(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												6344.3703	(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	3537.3481	0.2160	764.0672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.6565	0.2160	513.3578 (264)
Space and water heating			1277.4250 (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			1500.7848 (272)
Emissions per m2 for space and water heating			15.9042 (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) = (15.9042 * 1.00) + 2.2963 + 0.4846, rounded to 2 d.p.			18.6900 (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)				
Southwest				4.6800	36.7938	0.4600	0.0000	0.7700	60.9915 (79)				
Northwest				2.4700	11.2829	0.4600	0.0000	0.7700	9.8712 (81)				
Southwest				3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)				
Solar gains	128.7675	227.4361	332.6962	448.2778	535.0143	545.6195	520.0119	453.0898	372.3742	257.1645	155.7084	109.2439	(83)
Total gains	472.2857	569.6180	662.9388	758.8669	824.8456	816.0953	778.3288	715.2246	644.9708	549.5501	470.8618	442.2449	(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	0.9873	0.9763	0.9533	0.8993	0.7981	0.6476	0.5053	0.5597	0.7772	0.9322	0.9789	0.9897	(86)
MIT	18.9969	19.2552	19.6562	20.1648	20.5892	20.8577	20.9534	20.9344	20.7247	20.1595	19.4863	18.9562	(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	0.9846	0.9713	0.9431	0.8766	0.7516	0.5671	0.3958	0.4492	0.7096	0.9121	0.9736	0.9875	(89)
MIT 2	18.0746	18.3322	18.7285	19.2285	19.6188	19.8485	19.9108	19.9039	19.7502	19.2356	18.5734	18.0421	(90)
Living area fraction	18.3056	18.5634	18.9609	19.4630	19.8618	20.1013	20.1720	20.1620	19.9943	19.4670	18.8021	18.2711	(92)
MIT	18.3056	18.5634	18.9609	19.4630	19.8618	20.1013	20.1720	20.1620	19.9943	19.4670	18.8021	18.2711	(93)
Temperature adjustment	18.3056	18.5634	18.9609	19.4630	19.8618	20.1013	20.1720	20.1620	19.9943	19.4670	18.8021	18.2711	(93)
adjusted MIT	18.3056	18.5634	18.9609	19.4630	19.8618	20.1013	20.1720	20.1620	19.9943	19.4670	18.8021	18.2711	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	462.4853	548.6950	617.9342	656.6961	617.8128	474.2176	328.4288	339.5228	460.9070	495.5217	454.9708	434.6748	(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	1385.0348	1347.2504	1225.1495	1024.5164	789.5925	525.8429	341.4281	358.7824	566.0341	857.8108	1137.9684	1375.7449	(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	686.3769	536.6292	451.7682	264.8306	127.8041	0.0000	0.0000	0.0000	0.0000	269.5431	491.7583	700.1561	(98)
Space heating												3528.8664	(98)
Space heating per m2												43.9351	(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	0.8221	0.8795	0.8523	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	738.6941	622.1167	617.7702	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1046.1441	1000.1098	927.9568	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	221.3640	281.2269	230.7788	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			733.3697 (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	55.3410	70.3067	57.6947	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												183.3424 (107)
Energy for space heating												2.2826 (108)
Energy for space cooling												43.9351 (99)
Total												2.2826 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.2177 (109)
												46.2 (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)			
Southwest				8.0100	36.7938	0.6300	0.7000	0.7700	90.0698 (79)			
Northwest				2.4700	11.2829	0.6300	0.7000	0.7700	8.5171 (81)			
Solar gains	111.1039	196.2378	287.0590	386.7858	461.6243	470.7747	448.6799	390.9377	321.2941	221.8882	134.3492	94.2585 (83)
Total gains	454.6222	538.4197	617.3015	697.3749	751.4556	741.2506	706.9968	653.0725	593.8908	514.2739	449.5027	427.2595 (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, nilm (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	0.9985	0.9962	0.9893	0.9642	0.8893	0.7321	0.5637	0.6258	0.8658	0.9800	0.9967	0.9989 (86)
MIT	19.6576	19.8248	20.0937	20.4494	20.7555	20.9365	20.9861	20.9773	20.8455	20.4435	19.9866	19.6333 (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	0.9979	0.9948	0.9854	0.9501	0.8457	0.6396	0.4379	0.4979	0.7973	0.9697	0.9953	0.9985 (89)
MIT 2	18.6963	18.8652	19.1344	19.4920	19.7734	19.9217	19.9475	19.9466	19.8596	19.4932	19.0379	18.6809 (90)
Living area fraction									fLA = Living area / (4) =			0.2505 (91)
MIT	18.9371	19.1056	19.3747	19.7318	20.0194	20.1759	20.2076	20.2048	20.1066	19.7313	19.2756	18.9194 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9371	19.1056	19.3747	19.7318	20.0194	20.1759	20.2076	20.2048	20.1066	19.7313	19.2756	18.9194 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9972	0.9935	0.9827	0.9468	0.8496	0.6611	0.4698	0.5303	0.8094	0.9670	0.9941	0.9979 (94)
Ext temp.	453.3631	534.8956	606.6385	660.2406	638.4009	490.0185	332.1431	346.3094	480.7181	497.3145	446.8504	426.3832 (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	1413.7524	1367.9842	1236.1844	1025.6775	785.7122	520.1693	336.5502	354.1309	563.0157	862.3853	1156.0056	1405.2566 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	714.5297	559.8355	468.3821	263.1146	109.5996	0.0000	0.0000	0.0000	0.0000	271.6127	510.5917	728.2818 (98)
Space heating												3625.9478 (98)
Space heating per m2										(98) / (4) =		45.1438 (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	0.8678	0.9265	0.9015	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	760.9493	639.5992	637.6587	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	958.6632	916.7346	855.3115	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	142.3540	206.1888	161.9337	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												510.4765 (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	35.5885	51.5472	40.4834	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												127.6191 (107)
Space cooling per m2												1.5889 (108)
Energy for space heating												45.1438 (99)
Energy for space cooling												1.5889 (108)
Total												46.7327 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (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	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)
RHI water heating demand												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		Specific data or Table 6b		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)
Southwest			4.6800		40.4699		0.4600		0.0000		0.7700		67.0852 (79)
Northwest			2.4700		12.9236		0.4600		0.0000		0.7700		11.3065 (81)
Southwest			3.3300		40.4699		0.4600		0.0000		0.7700		47.7337 (79)
Solar gains	142.7418	227.3559	330.0176	460.8565	537.8410	587.7226	553.8038	492.1220	401.3018	274.8915	176.9240	119.8772	(83)
Total gains	698.8376	779.0844	860.3432	957.9945	1001.0045	1020.4366	968.7078	915.2842	843.5484	750.5378	689.6979	660.7357	(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	0.9572	0.9386	0.8963	0.8045	0.6551	0.4434	0.2992	0.3244	0.5859	0.8300	0.9303	0.9628 (86)
MIT	19.5259	19.7246	20.0874	20.5078	20.8167	20.9651	20.9933	20.9913	20.9070	20.5383	19.9850	19.4903 (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	0.9487	0.9268	0.8760	0.7672	0.5920	0.3567	0.1984	0.2196	0.4987	0.7883	0.9146	0.9553 (89)
MIT 2	18.0053	18.2907	18.8016	19.3752	19.7589	19.9171	19.9344	19.9374	19.8693	19.4332	18.6742	17.9608 (90)
Living area fraction	18.3862	18.6499	19.1237	19.6589	20.0239	20.1796	20.1996	20.2014	20.1292	19.7100	19.0025	18.3439 (91)
MIT	18.3862	18.6499	19.1237	19.6589	20.0239	20.1796	20.1996	20.2014	20.1292	19.7100	19.0025	18.3439 (92)
Temperature adjustment	18.2362	18.4999	18.9737	19.5089	19.8739	20.0296	20.0496	20.0514	19.9792	19.5600	18.8525	-0.1500
adjusted MIT	18.2362	18.4999	18.9737	19.5089	19.8739	20.0296	20.0496	20.0514	19.9792	19.5600	18.8525	18.1939 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	650.5715	706.2730	734.8044	718.9344	588.9835	371.9249	202.7937	211.2321	423.7374	578.6866	616.5477	620.2786	(94)
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	1267.6292	1238.7827	1111.4246	916.4022	655.5630	381.0760	203.7014	212.4947	451.9720	755.8714	1030.5404	1251.5737	(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	459.0910	357.8465	280.2055	142.1768	49.5351	0.0000	0.0000	0.0000	0.0000	131.8255	298.0747	469.6835	(98)
Space heating												2188.4386	(98)
RHI space heating demand												2188	(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)
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)

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)	
Southwest					4.6800	36.7938	0.4600	0.0000	0.7700		60.9915 (79)	
Northwest					2.4700	11.2829	0.4600	0.0000	0.7700		9.8712 (81)	
Southwest					3.3300	36.7938	0.4600	0.0000	0.7700		43.3978 (79)	
Solar gains	128.7675	227.4361	332.6962	448.2778	535.0143	545.6195	520.0119	453.0898	372.3742	257.1645	155.7084	109.2439 (83)
Total gains	684.8633	779.1646	863.0219	945.4158	998.1778	978.3335	934.9159	876.2520	814.6208	732.8108	668.4822	650.1024 (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	0.9649	0.9463	0.9118	0.8408	0.7248	0.5679	0.4315	0.4739	0.6825	0.8703	0.9465	0.9697 (86)
MIT	19.3257	19.5617	19.9184	20.3560	20.7000	20.9042	20.9708	20.9599	20.8181	20.3730	19.7783	19.2831 (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	0.9581	0.9361	0.8948	0.8101	0.6726	0.4898	0.3338	0.3740	0.6086	0.8383	0.9346	0.9638 (89)
MIT 2	17.7017	18.0409	18.5483	19.1608	19.6086	19.8526	19.9129	19.9078	19.7649	19.2010	18.3656	17.6476 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	18.1085	18.4219	18.8915	19.4602	19.8820	20.1160	20.1779	20.1713	20.0287	19.4946	18.7195	18.0573 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9585	18.2719	18.7415	19.3102	19.7320	19.9660	20.0279	20.0213	19.8787	19.3446	18.5695	17.9073 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9415	0.9162	0.8724	0.7902	0.6628	0.4927	0.3432	0.3829	0.6052	0.8177	0.9150	0.9486	(94)	
Useful gains	644.7936	713.8499	752.9206	747.0766	661.6291	482.0396	320.8958	335.5560	492.9710	599.2386	611.6360	616.6592	(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	1350.7108	1318.5046	1203.5826	1009.6935	777.0347	512.9082	327.6511	345.3675	554.9296	845.9652	1115.3510	1340.1772	(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	525.2024	406.3279	335.2925	189.0841	85.8618	0.0000	0.0000	0.0000	0.0000	183.5646	362.6748	538.2974	(98)	
Space heating												2626.3055	(98)	
Space heating per m2												(98) / (4) =	32.6980	(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													2901.9950 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	525.2024	406.3279	335.2925	189.0841	85.8618	0.0000	0.0000	0.0000	0.0000	183.5646	362.6748	538.2974	(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)	580.3341	448.9812	370.4890	208.9327	94.8749	0.0000	0.0000	0.0000	0.0000	202.8338	400.7456	594.8037	(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	89.7099	89.6329	89.4802	89.1492	88.5521	87.3000	87.3000	87.3000	87.3000	89.0967	89.5432	87.3000	(216)
Fuel for water heating, kWh/month	185.1663	162.5336	169.0689	149.4605	145.5102	129.0595	121.2740	136.7748	137.7020	155.2182	166.6386	179.7603	(219)
Water heating fuel used													1838.1669 (219)
Annual totals kWh/year													
Space heating fuel - main system													2901.9950 (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													5170.5277 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2901.9950	3.4800	100.9894 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1838.1669	3.4800	63.9682 (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			341.7229 (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] =	1.1453 (257)
SAP value		84.0237
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	2901.9950	0.2160	626.8309 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1838.1669	0.2160	397.0441 (264)
Space and water heating			1023.8750 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1247.2348 (272)
CO2 emissions per m2			15.5300 (273)
EI value			86.6638
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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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) (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 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)			
Southwest				4.6800	40.4699	0.4600	0.0000	0.7700	67.0852 (79)			
Northwest				2.4700	12.9236	0.4600	0.0000	0.7700	11.3065 (81)			
Southwest				3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (79)			
Solar gains	142.7418	227.3559	330.0176	460.8565	537.8410	587.7226	553.8038	492.1220	401.3018	274.8915	176.9240	119.8772 (83)
Total gains	698.8376	779.0844	860.3432	957.9945	1001.0045	1020.4366	968.7078	915.2842	843.5484	750.5378	689.6979	660.7357 (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	0.9572	0.9386	0.8963	0.8045	0.6551	0.4434	0.2992	0.3244	0.5859	0.8300	0.9303	0.9628 (86)
MIT	19.5259	19.7246	20.0874	20.5078	20.8167	20.9651	20.9933	20.9913	20.9070	20.5383	19.9850	19.4903 (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	0.9487	0.9268	0.8760	0.7672	0.5920	0.3567	0.1984	0.2196	0.4987	0.7883	0.9146	0.9553 (89)
MIT 2	18.0053	18.2907	18.8016	19.3752	19.7589	19.9171	19.9344	19.9374	19.8693	19.4332	18.6742	17.9608 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	18.3862	18.6499	19.1237	19.6589	20.0239	20.1796	20.1996	20.2014	20.1292	19.7100	19.0025	18.3439 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2362	18.4999	18.9737	19.5089	19.8739	20.0296	20.0496	20.0514	19.9792	19.5600	18.8525	18.1939 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9309	0.9065	0.8541	0.7505	0.5884	0.3645	0.2093	0.2308	0.5023	0.7710	0.8939	0.9388	(94)
Useful gains	650.5715	706.2730	734.8044	718.9344	588.9835	371.9249	202.7937	211.2321	423.7374	578.6866	616.5477	620.2786	(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	1267.6292	1238.7827	1111.4246	916.4022	655.5630	381.0760	203.7014	212.4947	451.9720	755.8714	1030.5404	1251.5737	(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	459.0910	357.8465	280.2055	142.1768	49.5351	0.0000	0.0000	0.0000	0.0000	131.8255	298.0747	469.6835	(98)
Space heating												2188.4386	(98)
Space heating per m2												(98) / (4) = 27.2465	(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													2418.1642 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.0910	357.8465	280.2055	142.1768	49.5351	0.0000	0.0000	0.0000	0.0000	131.8255	298.0747	469.6835	(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)	507.2828	395.4105	309.6193	157.1014	54.7349	0.0000	0.0000	0.0000	0.0000	145.6635	329.3643	518.9873	(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	89.6271	89.5503	89.3517	88.9231	88.1657	87.3000	87.3000	87.3000	87.3000	88.8329	89.4067	87.3000	(216)
Fuel for water heating, kWh/month	185.3373	162.6835	169.3121	149.8404	146.1480	129.0595	121.2740	136.7748	137.7020	155.6792	166.8930	179.9242	(219)
Water heating fuel used												1840.6280	(219)
Annual totals kWh/year													
Space heating fuel - main system												2418.1642	(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												4689.1580	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2418.1642	9.7400	235.5292 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1840.6280	9.7400	179.2772 (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			677.3961 (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	2418.1642	0.2160	522.3235 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1840.6280	0.2160	397.5756 (264)
Space and water heating			919.8991 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1143.2590 (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	2418.1642	1.2200	2950.1603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1840.6280	1.2200	2245.5662 (264)
Space and water heating			5195.7265 (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			6516.9494 (272)
Primary energy kWh/m2/year			81.1373 (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 (15.9%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (98.5%)

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	£519	£425	£94
Space heating	£367	£367	£0
Water heating	£179	£104	£75
Lighting	£131	£131	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£678	-£70	£748
Total cost of uses	£677	-£70	£747
Delivered energy	58 kWh/m ²	24 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	81 kWh/m ²	-1 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	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)

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												-20.4899 (63)
Solar input (sum of months) = Sum(63)m =												-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)
Total per year (kWh/year) = Sum(64)m =												794.2995 (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)	
Southwest				4.6800	36.7938	0.4600			0.0000	0.7700		60.9915 (79)	
Northwest				2.4700	11.2829	0.4600			0.0000	0.7700		9.8712 (81)	
Southwest				3.3300	36.7938	0.4600			0.0000	0.7700		43.3978 (79)	
Solar gains	128.7675	227.4361	332.6962	448.2778	535.0143	545.6195	520.0119	453.0898	372.3742	257.1645	155.7084	109.2439	(83)
Total gains	684.8633	779.1646	863.0219	945.4158	998.1778	978.3335	934.9159	876.2520	814.6208	732.8108	668.4822	650.1024	(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	0.9649	0.9463	0.9118	0.8408	0.7248	0.5679	0.4315	0.4739	0.6825	0.8703	0.9465	0.9697 (86)
MIT	19.3257	19.5617	19.9184	20.3560	20.7000	20.9042	20.9708	20.9599	20.8181	20.3730	19.7783	19.2831 (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	0.9581	0.9361	0.8948	0.8101	0.6726	0.4898	0.3338	0.3740	0.6086	0.8383	0.9346	0.9638 (89)
MIT 2	17.7017	18.0409	18.5483	19.1608	19.6086	19.8526	19.9129	19.9078	19.7649	19.2010	18.3656	17.6476 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	18.1085	18.4219	18.8915	19.4602	19.8820	20.1160	20.1779	20.1713	20.0287	19.4946	18.7195	18.0573 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9585	18.2719	18.7415	19.3102	19.7320	19.9660	20.0279	20.0213	19.8787	19.3446	18.5695	17.9073 (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	0.9415	0.9162	0.8724	0.7902	0.6628	0.4927	0.3432	0.3829	0.6052	0.8177	0.9150	0.9486	(94)
Useful gains	644.7936	713.8499	752.9206	747.0766	661.6291	482.0396	320.8958	335.5560	492.9710	599.2386	611.6360	616.6592	(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	1350.7108	1318.5046	1203.5826	1009.6935	777.0347	512.9082	327.6511	345.3675	554.9296	845.9652	1115.3510	1340.1772	(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	525.2024	406.3279	335.2925	189.0841	85.8618	0.0000	0.0000	0.0000	0.0000	183.5646	362.6748	538.2974	(98)
Space heating												2626.3055	(98)
Space heating per m2												32.6980	(99)
												(98) / (4) =	

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													2901.9950 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	525.2024	406.3279	335.2925	189.0841	85.8618	0.0000	0.0000	0.0000	0.0000	183.5646	362.6748	538.2974	(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)	580.3341	448.9812	370.4890	208.9327	94.8749	0.0000	0.0000	0.0000	0.0000	202.8338	400.7456	594.8037	(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	89.8009	89.8248	89.8547	89.9247	90.0476	87.3000	87.3000	87.3000	87.3000	89.4534	89.6819	87.3000	(216)
(217)m	89.8009	89.8248	89.8547	89.9247	90.0476	87.3000	87.3000	87.3000	87.3000	89.4534	89.6819	89.8173	(217)
Fuel for water heating, kWh/month	157.7126	116.6993	90.9203	44.4622	15.1443	0.0000	0.0000	24.9065	50.0868	96.2088	133.9967	156.7958	(219)
Water heating fuel used												886.9332	(219)
Annual totals kWh/year													
Space heating fuel - main system												2901.9950	(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												2542.0546	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2901.9950	3.4800	100.9894	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	886.9332	3.4800	30.8653	(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			87.3921	(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] =	0.2929 (257)
SAP value			95.9142
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	2901.9950	0.2160	626.8309 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	886.9332	0.2160	191.5776 (264)
Space and water heating			818.4085 (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			171.2811 (272)
CO2 emissions per m2			2.1300 (273)
EI value			98.1686
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
 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 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)
Southwest				4.6800	40.4699	0.4600		0.0000		0.7700		67.0852 (79)
Northwest				2.4700	12.9236	0.4600		0.0000		0.7700		11.3065 (81)
Southwest				3.3300	40.4699	0.4600		0.0000		0.7700		47.7337 (79)

Solar gains	142.7418	227.3559	330.0176	460.8565	537.8410	587.7226	553.8038	492.1220	401.3018	274.8915	176.9240	119.8772 (83)
Total gains	698.8376	779.0844	860.3432	957.9945	1001.0045	1020.4366	968.7078	915.2842	843.5484	750.5378	689.6979	660.7357 (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	0.9572	0.9386	0.8963	0.8045	0.6551	0.4434	0.2992	0.3244	0.5859	0.8300	0.9303	0.9628	(86)
MIT	19.5259	19.7246	20.0874	20.5078	20.8167	20.9651	20.9933	20.9913	20.9070	20.5383	19.9850	19.4903	(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	0.9487	0.9268	0.8760	0.7672	0.5920	0.3567	0.1984	0.2196	0.4987	0.7883	0.9146	0.9553	(89)
MIT 2	18.0053	18.2907	18.8016	19.3752	19.7589	19.9171	19.9344	19.9374	19.8693	19.4332	18.6742	17.9608	(90)
Living area fraction													
MIT	18.3862	18.6499	19.1237	19.6589	20.0239	20.1796	20.1996	20.2014	20.1292	19.7100	19.0025	18.3439	(92)
Temperature adjustment													
adjusted MIT	18.2362	18.4999	18.9737	19.5089	19.8739	20.0296	20.0496	20.0514	19.9792	19.5600	18.8525	18.1939	(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	0.9309	0.9065	0.8541	0.7505	0.5884	0.3645	0.2093	0.2308	0.5023	0.7710	0.8939	0.9388	(94)
Useful gains	650.5715	706.2730	734.8044	718.9344	588.9835	371.9249	202.7937	211.2321	423.7374	578.6866	616.5477	620.2786	(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	1267.6292	1238.7827	1111.4246	916.4022	655.5630	381.0760	203.7014	212.4947	451.9720	755.8714	1030.5404	1251.5737	(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	459.0910	357.8465	280.2055	142.1768	49.5351	0.0000	0.0000	0.0000	0.0000	131.8255	298.0747	469.6835	(98)
Space heating												2188.4386	(98)
Space heating per m2											(98) / (4) =	27.2465	(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													2418.1642 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.0910	357.8465	280.2055	142.1768	49.5351	0.0000	0.0000	0.0000	0.0000	131.8255	298.0747	469.6835	(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)	507.2828	395.4105	309.6193	157.1014	54.7349	0.0000	0.0000	0.0000	0.0000	145.6635	329.3643	518.9873	(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	89.7329	89.7488	89.7395	89.7691	89.6503	87.3000	87.3000	87.3000	87.3000	89.2275	89.5743	87.3000	(216)
(217)m	89.7329	89.7488	89.7395	89.7691	89.6503	87.3000	87.3000	87.3000	87.3000	89.2275	89.5743	87.3000	(217)
Fuel for water heating, kWh/month	155.6111	117.9815	93.8949	45.2242	19.2706	0.0000	0.0000	19.5389	46.1990	94.0877	130.6499	155.3056	(219)
Water heating fuel used												877.7635	(219)
Annual totals kWh/year													
Space heating fuel - main system												2418.1642	(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												1952.1339	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2418.1642	9.7400	235.5292	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	877.7635	9.7400	85.4942	(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			-70.1647	(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	2418.1642	0.2160	522.3235	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	877.7635	0.2160	189.5969	(264)
Space and water heating			711.9204	(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			14.4914 (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	2418.1642	1.2200	2950.1603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	877.7635	1.2200	1070.8715 (264)
Space and water heating			4021.0318 (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			-104.4153 (272)
Primary energy kWh/m2/year			-1.3000 (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 West	0.000	1.000	None
North West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.6300	98.8453	0.4600	0.0000	0.9000	148.5466
South West	4.6800	119.9223	0.4600	0.0000	0.9000	232.3519
North West	2.4700	98.8453	0.4600	0.0000	0.9000	101.0772
South West	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273
total:						647.3031

	Jun	Jul	Aug	
Solar gains	687	647	575	(P4)
Internal gains	430	412	420	
Total summer gains	1117	1059	995	(P5)
Summer gain/loss ratio	3.37	3.20	3.00	(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	20.34	22.06	21.77	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			