

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-622				Issued on Date	22/03/2023
Assessment Reference	Plot 622	Prop Type Ref	2-As-END			
Property	Plot 622, 2 Bed, K, WC, B					
SAP Rating	84 B	DER	16.71	TER	18.34	
Environmental	87 B	% DER<TER	8.87			
CO ₂ Emissions (t/year)	1.12	DFEE	44.57	TFEE	51.78	
General Requirements Compliance	Pass	% DFEE<TFEE	13.93			
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

End-Terrace 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) 18.34 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.71 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.63 m², No overhang
Windows facing South: 8.01 m², No overhang
Windows facing 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) (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	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)

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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)
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	
North					3.6300	10.6334	0.4600	0.0000	0.7700		13.6718 (74)	
South					4.6800	46.7521	0.4600	0.0000	0.7700		77.4988 (78)	
West					2.4700	19.6403	0.4600	0.0000	0.7700		17.1828 (80)	
South					3.3300	46.7521	0.4600	0.0000	0.7700		55.1434 (78)	
Solar gains	163.4968	276.9745	376.4705	464.7973	520.9129	517.7653	498.8873	456.6059	406.8251	305.2933	195.5172	140.1429 (83)
Total gains	539.3710	650.7311	736.6656	803.1364	837.0632	812.5480	779.8046	743.5315	704.9938	625.5301	541.0957	504.7242 (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	0.9816	0.9661	0.9393	0.8860	0.7928	0.6495	0.5045	0.5429	0.7426	0.9081	0.9691	0.9849 (86)
MIT	19.1037	19.3780	19.7577	20.2143	20.5982	20.8565	20.9536	20.9401	20.7627	20.2544	19.5942	19.0570 (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	0.9778	0.9593	0.9266	0.8612	0.7458	0.5690	0.3951	0.4341	0.6717	0.8828	0.9616	0.9818 (89)
MIT 2	17.3830	17.7805	18.3261	18.9759	19.4912	19.8105	19.9030	19.8954	19.7094	19.0463	18.1058	17.3221 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	17.8140	18.1806	18.6847	19.2861	19.7685	20.0725	20.1662	20.1571	19.9733	19.3489	18.4786	17.7567 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6640	18.0306	18.5347	19.1361	19.6185	19.9225	20.0162	20.0071	19.8233	19.1989	18.3286	17.6067 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9663	0.9430	0.9060	0.8395	0.7310	0.5685	0.4047	0.4425	0.6642	0.8615	0.9462	0.9718	(94)
Useful gains	521.2059	613.6465	667.4003	674.2361	611.8810	461.9522	315.5521	329.0051	468.2648	538.8841	511.9967	490.5143	(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	1321.5862	1294.7174	1183.2472	992.8100	766.0532	508.7471	326.5348	344.0058	549.6089	831.8760	1091.9294	1310.7882	(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	595.4830	457.6796	383.7901	229.3732	114.7041	0.0000	0.0000	0.0000	0.0000	217.9860	417.5515	610.2838	(98)
Space heating												3026.8512	(98)
Space heating per m2												(98) / (4) = 37.6849	(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												3344.5870 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	595.4830	457.6796	383.7901	229.3732	114.7041	0.0000	0.0000	0.0000	0.0000	217.9860	417.5515	610.2838 (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)	657.9922	505.7233	424.0774	253.4510	126.7449	0.0000	0.0000	0.0000	0.0000	240.8685	461.3829	674.3467 (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	89.7822	89.7061	89.5717	89.2973	88.7784	87.3000	87.3000	87.3000	87.3000	89.2304	89.6350	87.3000 (216)
Fuel for water heating, kWh/month	185.0171	162.4010	168.8962	149.2126	145.1393	129.0595	121.2740	136.7748	137.7020	154.9857	166.4680	179.6198 (219)
Water heating fuel used												1836.5501 (219)
Annual totals kWh/year												
Space heating fuel - main system												3344.5870 (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												5611.5029 (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	3344.5870	0.2160	722.4308 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1836.5501	0.2160	396.6948 (264)
Space and water heating			1119.1256 (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			1342.4855 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.7100 (273)

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

DER		16.7100 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		35.1683 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		35.1683 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
North					3.6300	10.6334	0.6300	0.7000			0.7700			11.7964 (74)
South					8.0100	46.7521	0.6300	0.7000			0.7700			114.4472 (78)
West					2.4700	19.6403	0.6300	0.7000			0.7700			14.8257 (80)
Solar gains	141.0693	238.9808	324.8286	401.0393	449.4572	446.7414	430.4530	393.9714	351.0193	263.4151	168.6973	120.9189	(83)	
Total gains	529.1369	624.6653	696.3306	750.0670	775.6727	750.9681	720.8230	690.9705	659.8890	594.9711	526.2107	497.6985	(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	0.9970	0.9928	0.9826	0.9534	0.8788	0.7255	0.5541	0.5968	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7428	19.9219	20.1789	20.4991	20.7711	20.9391	20.9871	20.9815	20.8799	20.5251	20.0735	19.7143	(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	0.9960	0.9903	0.9765	0.9360	0.8329	0.6329	0.4298	0.4722	0.7469	0.9484	0.9908	0.9970	(89)
MIT 2	18.2530	18.5156	18.8894	19.3525	19.7142	19.9101	19.9462	19.9456	19.8524	19.3978	18.7473	18.2192	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6262	18.8679	19.2124	19.6397	19.9790	20.1678	20.2070	20.2051	20.1098	19.6802	19.0795	18.5938	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6262	18.8679	19.2124	19.6397	19.9790	20.1678	20.2070	20.2051	20.1098	19.6802	19.0795	18.5938	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9941	0.9870	0.9711	0.9299	0.8349	0.6535	0.4612	0.5035	0.7605	0.9431	0.9877	0.9956	(94)
Ext temp.	526.0388	616.5371	676.1749	697.4796	647.5903	490.7808	332.4261	347.9171	501.8323	561.1457	519.7514	495.4919	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1383.7260	1345.0926	1220.6033	1016.9520	781.8901	519.4142	336.4881	354.1569	563.3155	857.5581	1137.3928	1374.1626	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	638.1193	489.5893	405.0547	230.0201	99.9191	0.0000	0.0000	0.0000	0.0000	220.5308	444.7018	653.7310	(98)
Space heating per m2												3181.6660	(98)
										(98) / (4) =		39.6124	(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													3406.4947 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	638.1193	489.5893	405.0547	230.0201	99.9191	0.0000	0.0000	0.0000	0.0000	220.5308	444.7018	653.7310	(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)	683.2112	524.1855	433.6774	246.2742	106.9797	0.0000	0.0000	0.0000	0.0000	236.1144	476.1261	699.9261	(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	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	87.7425	87.4697	86.9711	85.9024	83.9210	80.3000	80.3000	80.3000	80.3000	85.6782	87.1954	80.3000	(216)
Fuel for water heating, kWh/month	230.6752	203.2082	212.6369	190.9445	189.2327	174.1812	166.8789	186.0308	188.0853	200.7285	210.5455	224.9906	(219)
Water heating fuel used												2378.1382	(219)
Annual totals kWh/year													
Space heating fuel - main system												3406.4947	(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												6214.9987	(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	3406.4947	0.2160	735.8029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2378.1382	0.2160	513.6779 (264)
Space and water heating			1249.4807 (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			1472.8405 (272)
Emissions per m2 for space and water heating			15.5563 (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) = (15.5563 * 1.00) + 2.2963 + 0.4846, rounded to 2 d.p.			18.3400 (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
North			3.6300		10.6334		0.4600		0.0000		0.7700		13.6718 (74)
South			4.6800		46.7521		0.4600		0.0000		0.7700		77.4988 (78)
West			2.4700		19.6403		0.4600		0.0000		0.7700		17.1828 (80)
South			3.3300		46.7521		0.4600		0.0000		0.7700		55.1434 (78)
Solar gains	163.4968	276.9745	376.4705	464.7973	520.9129	517.7653	498.8873	456.6059	406.8251	305.2933	195.5172		140.1429 (83)
Total gains	507.0151	619.1564	706.7131	775.3865	810.7442	788.2411	757.2042	718.7406	679.4217	597.6790	510.6706		473.1439 (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	0.9845	0.9703	0.9452	0.8944	0.8042	0.6627	0.5169	0.5576	0.7572	0.9173	0.9736	0.9875	(86)
MIT	19.0525	19.3308	19.7171	20.1836	20.5784	20.8473	20.9502	20.9351	20.7473	20.2206	19.5479	19.0063	(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	0.9812	0.9642	0.9335	0.8709	0.7584	0.5823	0.4058	0.4473	0.6876	0.8939	0.9671	0.9848	(89)
MIT 2	18.1295	18.4062	18.7869	19.2456	19.6100	19.8420	19.9095	19.9042	19.7664	19.2917	18.6336	18.0918	(90)
Living area fraction	18.3607	18.6378	19.0199	19.4806	19.8526	20.0938	20.1702	20.1624	20.0121	19.5244	18.8627	18.3208	(92)
Temperature adjustment	18.3607	18.6378	19.0199	19.4806	19.8526	20.0938	20.1702	20.1624	20.0121	19.5244	18.8627	18.3208	(92)
adjusted MIT	18.3607	18.6378	19.0199	19.4806	19.8526	20.0938	20.1702	20.1624	20.0121	19.5244	18.8627	18.3208	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	494.3798	591.3448	651.5206	666.6731	612.3829	469.5820	327.3045	339.7944	471.5276	528.0362	489.6268	463.4600	(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	1390.4799	1354.5824	1230.9555	1026.2177	788.6981	525.1262	341.2563	358.8239	567.7440	863.3639	1143.8607	1380.6081	(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	666.6985	512.8957	431.0996	258.8721	131.1785	0.0000	0.0000	0.0000	0.0000	249.4838	471.0484	682.3582	(98)
Space heating													3403.6348 (98)
Space heating per m2													42.3759 (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	0.8114	0.8730	0.8536	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	729.0789	617.4779	618.7169	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1013.5872	975.4187	932.0665	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	204.8460	266.3079	233.1321	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			704.2860 (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	51.2115	66.5770	58.2830	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												176.0715 (107)
Energy for space heating												2.1921 (108)
Energy for space cooling												42.3759 (99)
Total												2.1921 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.5681 (109)
												44.6 (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	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W
North	3.6300	10.6334	0.6300	0.7000	0.7700	11.7964 (74)
South	8.0100	46.7521	0.6300	0.7000	0.7700	114.4472 (78)
West	2.4700	19.6403	0.6300	0.7000	0.7700	14.8257 (80)

Solar gains	141.0693	238.9808	324.8286	401.0393	449.4572	446.7414	430.4530	393.9714	351.0193	263.4151	168.6973	120.9189 (83)
Total gains	484.5876	581.1628	655.0711	711.6284	739.2885	717.2172	688.7699	656.1062	623.6160	555.8007	483.8508	453.9199 (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)												
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	0.9979	0.9947	0.9864	0.9614	0.8945	0.7486	0.5769	0.6234	0.8472	0.9730	0.9954	0.9985 (86)
MIT	19.6919	19.8731	20.1348	20.4631	20.7474	20.9298	20.9847	20.9777	20.8620	20.4863	20.0257	19.6640 (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	0.9972	0.9929	0.9815	0.9465	0.8521	0.6568	0.4490	0.4957	0.7745	0.9596	0.9935	0.9980 (89)
MIT 2	18.7306	18.9132	19.1746	19.5047	19.7669	19.9181	19.9470	19.9468	19.8707	19.5336	19.0767	18.7115 (90)
Living area fraction									fLA = Living area / (4) =			0.2505 (91)
MIT	18.9714	19.1536	19.4151	19.7448	20.0125	20.1716	20.2070	20.2050	20.1190	19.7722	19.3144	18.9501 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9714	19.1536	19.4151	19.7448	20.0125	20.1716	20.2070	20.2050	20.1190	19.7722	19.3144	18.9501 (93)

8. Space heating requirement

Utilisation	0.9964	0.9911	0.9784	0.9431	0.8555	0.6778	0.4814	0.5281	0.7882	0.9568	0.9920	0.9973 (94)
Useful gains	482.8325	575.9930	640.9512	671.1614	632.4854	486.1390	331.5830	346.4674	491.5092	531.8094	479.9940	452.7127 (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	1417.0637	1372.6110	1240.0653	1026.9058	785.0609	519.7616	336.4876	354.1482	564.1783	866.2508	1159.6929	1408.1853 (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	695.0680	535.3273	445.7409	256.1360	113.5162	0.0000	0.0000	0.0000	0.0000	248.8244	489.3832	710.8716 (98)
Space heating												3494.8675 (98)
Space heating per m2										(98) / (4) =		43.5118 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.8567	0.9207	0.9027	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	751.2245	635.5721	638.5311	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	930.5723	895.4305	858.8574	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	129.1304	193.3347	163.9227	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												486.3878 (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	32.2826	48.3337	40.9807	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												121.5970 (107)
Space cooling per m2												1.5139 (108)
Energy for space heating												43.5118 (99)
Energy for space cooling												1.5139 (108)
Total												45.0257 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (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/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	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	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 (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 (57)
Combi loss	14.6712	13.2321	14.6052	14.0835	14.5162	14.0056	14.4461	14.4916	14.0481	14.5684	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	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	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	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
North			3.6300		11.9814		0.4600		0.0000		0.7700		15.4051 (74)
South			4.6800		50.9848		0.4600		0.0000		0.7700		84.5153 (78)
West			2.4700		22.3313		0.4600		0.0000		0.7700		19.5371 (80)
South			3.3300		50.9848		0.4600		0.0000		0.7700		60.1359 (78)
Solar gains	179.5934	273.7097	368.2329	471.1778	517.5370	552.0486	525.5317	489.4052	432.1377	322.2416	219.9852	152.4905	(83)
Total gains	735.6892	825.4383	898.5585	968.3158	980.7005	984.7626	940.4357	912.5674	874.3843	797.8879	732.7590	693.3490	(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	0.9512	0.9293	0.8859	0.8008	0.6640	0.4575	0.3078	0.3253	0.5701	0.8094	0.9194	0.9578 (86)
MIT	19.5784	19.7857	20.1300	20.5158	20.8089	20.9617	20.9927	20.9912	20.9143	20.5775	20.0400	19.5379 (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	0.9417	0.9161	0.8642	0.7631	0.6010	0.3688	0.2043	0.2202	0.4838	0.7652	0.9018	0.9494 (89)
MIT 2	18.0796	18.3760	18.8588	19.3850	19.7510	19.9149	19.9342	19.9374	19.8753	19.4806	18.7495	18.0285 (90)
Living area fraction	18.4550	18.7291	19.1772	19.6682	20.0160	20.1771	20.1993	20.2014	20.1355	19.7554	19.0727	18.4066 (92)
MIT	18.4550	18.7291	19.1772	19.6682	20.0160	20.1771	20.1993	20.2014	20.1355	19.7554	19.0727	18.4066 (92)
Temperature adjustment	18.3050	18.5791	19.0272	19.5182	19.8660	20.0271	20.0493	20.0514	19.9855	19.6054	18.9227	-0.1500
adjusted MIT	18.3050	18.5791	19.0272	19.5182	19.8660	20.0271	20.0493	20.0514	19.9855	19.6054	18.9227	18.2566 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9229	0.8951	0.8424	0.7466	0.5969	0.3765	0.2155	0.2315	0.4879	0.7494	0.8806	0.9319 (94)
Useful gains	678.9532	738.8104	756.9483	722.9279	585.3797	370.7606	202.6816	211.2173	426.6373	597.9230	645.2895	646.1220 (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	1274.2711	1246.3906	1116.5672	917.2922	654.8089	380.8394	203.6748	212.4913	452.5659	760.1784	1037.2072	1257.5685 (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	442.9165	341.0939	267.5565	139.9423	51.6553	0.0000	0.0000	0.0000	0.0000	120.7180	282.1808	454.9162 (98)
Space heating												2100.9795 (98)
RHI space heating demand												2101 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3654 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4658	0.4567	0.4476	0.4019	0.3928	0.3471	0.3471	0.3380	0.3654	0.3928	0.4110	0.4293 (22b)
	0.6085	0.6043	0.6002	0.5808	0.5771	0.5602	0.5602	0.5571	0.5667	0.5771	0.5845	0.5922 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			10.7800	1.2357	13.3213		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			40.1600	0.1200	4.8192	75.0000	3012.0000 (28a)
EW Brick AAC015	92.7000	16.2400	76.4600	0.2500	19.1150	52.3000	3998.8580 (29a)
Plane Ceiling	40.1600		40.1600	0.1600	6.4256	9.0000	361.4400 (30)
Total net area of external elements Aum(A, m ²)			173.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5651		(33)
E-WM-30			47.7700	0.0000	0.0000	45.0000	2149.6500 (32)
GF Timber			65.5800			9.0000	590.2200 (32c)
1F Timber			75.6200			9.0000	680.5800 (32c)
Internal Floor			40.1600			18.0000	722.8800 (32d)
Internal Ceiling			40.1600			9.0000	361.4400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11877.0680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.8719 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6335 (36)
Total fabric heat loss							(33) + (36) = 57.1986 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.6928	41.4042	41.1212	39.7921	39.5434	38.3858	38.3858	38.1715	38.8317	39.5434	40.0465	40.5724 (38)
Heat transfer coeff	98.8914	98.6027	98.3198	96.9907	96.7420	95.5844	95.5844	95.3700	96.0303	96.7420	97.2450	97.7710 (39)
Average = Sum(39)m / 12 =												96.9895 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2312	1.2276	1.2241	1.2076	1.2045	1.1900	1.1900	1.1874	1.1956	1.2045	1.2107	1.2173 (40)
HLP (average)												1.2075 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4689 (42)
Average daily hot water use (litres/day)												92.8365 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201 (44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 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
North			3.6300		10.6334		0.4600		0.0000		0.7700		13.6718 (74)
South			4.6800		46.7521		0.4600		0.0000		0.7700		77.4988 (78)
West			2.4700		19.6403		0.4600		0.0000		0.7700		17.1828 (80)
South			3.3300		46.7521		0.4600		0.0000		0.7700		55.1434 (78)

Solar gains	163.4968	276.9745	376.4705	464.7973	520.9129	517.7653	498.8873	456.6059	406.8251	305.2933	195.5172	140.1429	(83)
Total gains	719.5927	828.7030	906.7962	961.9354	984.0764	950.4793	913.7913	879.7681	849.0717	780.9396	708.2910	681.0014	(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	0.9601	0.9375	0.9014	0.8354	0.7306	0.5806	0.4404	0.4723	0.6647	0.8523	0.9382	0.9657 (86)
MIT	19.3765	19.6287	19.9700	20.3708	20.6923	20.8976	20.9690	20.9603	20.8323	20.4205	19.8324	19.3293 (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	0.9524	0.9259	0.8829	0.8041	0.6787	0.5018	0.3411	0.3727	0.5904	0.8176	0.9248	0.9591 (89)
MIT 2	17.7741	18.1350	18.6188	19.1798	19.6000	19.8470	19.9119	19.9080	19.7786	19.2614	18.4411	17.7137 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	18.1755	18.5092	18.9573	19.4781	19.8736	20.1102	20.1767	20.1716	20.0426	19.5517	18.7896	18.1184 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0255	18.3592	18.8073	19.3281	19.7236	19.9602	20.0267	20.0216	19.8926	19.4017	18.6396	17.9684 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9348	0.9050	0.8604	0.7845	0.6685	0.5043	0.3506	0.3816	0.5880	0.7980	0.9043	0.9429	(94)	
Useful gains	672.6779	749.9854	780.1912	754.6511	657.8865	479.3251	320.3434	335.6873	499.2690	623.1748	640.5221	642.1012	(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	1357.3297	1327.1118	1210.0507	1011.4306	776.2211	512.3521	327.5359	345.3947	556.2642	851.4970	1122.1672	1346.1517	(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	509.3809	387.8289	319.8155	184.8812	88.0409	0.0000	0.0000	0.0000	0.0000	169.8718	346.7845	523.8136	(98)	
Space heating												2530.4173	(98)	
Space heating per m2												(98) / (4) =	31.5042	(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												2796.0413 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	509.3809	387.8289	319.8155	184.8812	88.0409	0.0000	0.0000	0.0000	0.0000	169.8718	346.7845	523.8136 (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)	562.8519	428.5403	353.3872	204.2887	97.2828	0.0000	0.0000	0.0000	0.0000	187.7036	383.1873	578.7995 (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	89.6915	89.6031	89.4471	89.1316	88.5713	87.3000	87.3000	87.3000	87.3000	89.0354	89.5129	87.3000 (216)
Fuel for water heating, kWh/month	185.2042	162.5876	169.1315	149.4899	145.4787	129.0595	121.2740	136.7748	137.7020	155.3252	166.6951	179.7922 (219)
Water heating fuel used												1838.5146 (219)
Annual totals kWh/year												
Space heating fuel - main system												2796.0413 (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												5064.9216 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2796.0413	3.4800	97.3022 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1838.5146	3.4800	63.9803 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	355.3658	13.1900	46.8727 (250)
Additional standing charges			120.0000 (251)
Total energy cost			338.0478 (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] =	1.1329 (257)
SAP value		84.1955
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	2796.0413	0.2160	603.9449 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1838.5146	0.2160	397.1192 (264)
Space and water heating			1001.0641 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1224.4239 (272)
CO2 emissions per m2			15.2400 (273)
EI value			86.9077
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8866 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8866 = 0.2436$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(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 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	
North				3.6300	11.9814	0.4600	0.0000		0.7700		15.4051 (74)	
South				4.6800	50.9848	0.4600	0.0000		0.7700		84.5153 (78)	
West				2.4700	22.3313	0.4600	0.0000		0.7700		19.5371 (80)	
South				3.3300	50.9848	0.4600	0.0000		0.7700		60.1359 (78)	

Solar gains	179.5934	273.7097	368.2329	471.1778	517.5370	552.0486	525.5317	489.4052	432.1377	322.2416	219.9852	152.4905 (83)
Total gains	735.6892	825.4383	898.5585	968.3158	980.7005	984.7626	940.4357	912.5674	874.3843	797.8879	732.7590	693.3490 (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	0.9512	0.9293	0.8859	0.8008	0.6640	0.4575	0.3078	0.3253	0.5701	0.8094	0.9194	0.9578 (86)
MIT	19.5784	19.7857	20.1300	20.5158	20.8089	20.9617	20.9927	20.9912	20.9143	20.5775	20.0400	19.5379 (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	0.9417	0.9161	0.8642	0.7631	0.6010	0.3688	0.2043	0.2202	0.4838	0.7652	0.9018	0.9494 (89)
MIT 2	18.0796	18.3760	18.8588	19.3850	19.7510	19.9149	19.9342	19.9374	19.8753	19.4806	18.7495	18.0285 (90)
Living area fraction	fLA = Living area / (4) = 0.2505 (91)											
MIT	18.4550	18.7291	19.1772	19.6682	20.0160	20.1771	20.1993	20.2014	20.1355	19.7554	19.0727	18.4066 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.3050	18.5791	19.0272	19.5182	19.8660	20.0271	20.0493	20.0514	19.9855	19.6054	18.9227	18.2566 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9229	0.8951	0.8424	0.7466	0.5969	0.3765	0.2155	0.2315	0.4879	0.7494	0.8806	0.9319	(94)
Useful gains	678.9532	738.8104	756.9483	722.9279	585.3797	370.7606	202.6816	211.2173	426.6373	597.9230	645.2895	646.1220	(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	1274.2711	1246.3906	1116.5672	917.2922	654.8089	380.8394	203.6748	212.4913	452.5659	760.1784	1037.2072	1257.5685	(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	442.9165	341.0939	267.5565	139.9423	51.6553	0.0000	0.0000	0.0000	0.0000	120.7180	282.1808	454.9162	(98)
Space heating												2100.9795	(98)
Space heating per m2												(98) / (4) = 26.1576	(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													2321.5243 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.9165	341.0939	267.5565	139.9423	51.6553	0.0000	0.0000	0.0000	0.0000	120.7180	282.1808	454.9162	(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)	489.4105	376.8993	295.6425	154.6324	57.0777	0.0000	0.0000	0.0000	0.0000	133.3901	311.8019	502.6699	(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	89.6042	89.5180	89.3175	88.9104	88.1924	87.3000	87.3000	87.3000	87.3000	88.7628	89.3670	87.3000	(216)
Fuel for water heating, kWh/month	185.3847	162.7422	169.3770	149.8618	146.1037	129.0595	121.2740	136.7748	137.7020	155.8022	166.9673	179.9642	(219)
Water heating fuel used												1841.0135	(219)
Annual totals kWh/year													
Space heating fuel - main system												2321.5243	(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												4592.9036	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2321.5243	9.7400	226.1165 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1841.0135	9.7400	179.3147 (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			668.0210 (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	2321.5243	0.2160	501.4493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1841.0135	0.2160	397.6589 (264)
Space and water heating			899.1082 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.3658	0.5190	184.4348 (268)
Total kg/year			1122.4680 (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	2321.5243	1.2200	2832.2597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1841.0135	1.2200	2246.0364 (264)
Space and water heating			5078.2961 (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			6399.5191 (272)
Primary energy kWh/m2/year			79.6753 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 75	-182 kg (16.2%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (100.7%)

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	£509	£416	£94
Space heating	£358	£358	£0
Water heating	£179	£104	£75
Lighting	£131	£131	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£668	-£79	£748
Total cost of uses	£668	-£79	£747
Delivered energy	57 kWh/m ²	23 kWh/m ²	34 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m ²	14 kg/m ²	0 kg/m ²	14 kg/m ²
Primary energy	80 kWh/m ²	-3 kWh/m ²	82 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1600 (1b)	x 2.5400 (2b)	= 102.0064 (1b) - (3b)
First floor	40.1600 (1c)	x 2.6300 (2c)	= 105.6208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.6272 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1445 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3950 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3654 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	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 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												-844.3736 (H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899 (63)
												-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)
												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			
North				3.6300	10.6334	0.4600	0.0000	0.7700	13.6718 (74)			
South				4.6800	46.7521	0.4600	0.0000	0.7700	77.4988 (78)			
West				2.4700	19.6403	0.4600	0.0000	0.7700	17.1828 (80)			
South				3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)			
Solar gains	163.4968	276.9745	376.4705	464.7973	520.9129	517.7653	498.8873	456.6059	406.8251	305.2933	195.5172	140.1429 (83)
Total gains	719.5927	828.7030	906.7962	961.9354	984.0764	950.4793	913.7913	879.7681	849.0717	780.9396	708.2910	681.0014 (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	0.9601	0.9375	0.9014	0.8354	0.7306	0.5806	0.4404	0.4723	0.6647	0.8523	0.9382	0.9657 (86)
MIT	19.3765	19.6287	19.9700	20.3708	20.6923	20.8976	20.9690	20.9603	20.8323	20.4205	19.8324	19.3293 (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	0.9524	0.9259	0.8829	0.8041	0.6787	0.5018	0.3411	0.3727	0.5904	0.8176	0.9248	0.9591 (89)
MIT 2	17.7741	18.1350	18.6188	19.1798	19.6000	19.8470	19.9119	19.9080	19.7786	19.2614	18.4411	17.7137 (90)
Living area fraction	fLA = Living area / (4) =											0.2505 (91)
MIT	18.1755	18.5092	18.9573	19.4781	19.8736	20.1102	20.1767	20.1716	20.0426	19.5517	18.7896	18.1184 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0255	18.3592	18.8073	19.3281	19.7236	19.9602	20.0267	20.0216	19.8926	19.4017	18.6396	17.9684 (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	0.9348	0.9050	0.8604	0.7845	0.6685	0.5043	0.3506	0.3816	0.5880	0.7980	0.9043	0.9429	(94)
Useful gains	672.6779	749.9854	780.1912	754.6511	657.8865	479.3251	320.3434	335.6873	499.2690	623.1748	640.5221	642.1012	(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	1357.3297	1327.1118	1210.0507	1011.4306	776.2211	512.3521	327.5359	345.3947	556.2642	851.4970	1122.1672	1346.1517	(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	509.3809	387.8289	319.8155	184.8812	88.0409	0.0000	0.0000	0.0000	0.0000	169.8718	346.7845	523.8136	(98)
Space heating												2530.4173	(98)
Space heating per m2											(98) / (4) =	31.5042	(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													2796.0413 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	509.3809	387.8289	319.8155	184.8812	88.0409	0.0000	0.0000	0.0000	0.0000	169.8718	346.7845	523.8136	(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)	562.8519	428.5403	353.3872	204.2887	97.2828	0.0000	0.0000	0.0000	0.0000	187.7036	383.1873	578.7995	(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	89.7840	89.7996	89.8300	89.9140	90.0573	87.3000	87.3000	87.3000	87.3000	89.3981	89.6543	87.3000	(216)
(217)m	89.7840	89.7996	89.8300	89.9140	90.0573	87.3000	87.3000	87.3000	87.3000	89.3981	89.6543	89.8025	(217)
Fuel for water heating, kWh/month	157.7422	116.7320	90.9453	44.4674	15.1427	0.0000	0.0000	24.9065	50.0868	96.2683	134.0379	156.8216	(219)
Water heating fuel used												887.1507	(219)
Annual totals kWh/year													
Space heating fuel - main system												2796.0413	(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												2436.3184	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2796.0413	3.4800	97.3022	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	887.1507	3.4800	30.8728	(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			83.7125	(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] =	0.2806 (257)
SAP value			96.0862
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	2796.0413	0.2160	603.9449 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	887.1507	0.2160	191.6246 (264)
Space and water heating			795.5695 (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			148.4421 (272)
CO2 emissions per m2			1.8500 (273)
EI value			98.4128
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		(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	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	
North				3.6300	11.9814	0.4600		0.0000		0.7700		15.4051 (74)	
South				4.6800	50.9848	0.4600		0.0000		0.7700		84.5153 (78)	
West				2.4700	22.3313	0.4600		0.0000		0.7700		19.5371 (80)	
South				3.3300	50.9848	0.4600		0.0000		0.7700		60.1359 (78)	
Solar gains	179.5934	273.7097	368.2329	471.1778	517.5370	552.0486	525.5317	489.4052	432.1377	322.2416	219.9852	152.4905 (83)	
Total gains	735.6892	825.4383	898.5585	968.3158	980.7005	984.7626	940.4357	912.5674	874.3843	797.8879	732.7590	693.3490 (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	0.9512	0.9293	0.8859	0.8008	0.6640	0.4575	0.3078	0.3253	0.5701	0.8094	0.9194	0.9578	(86)
MIT	19.5784	19.7857	20.1300	20.5158	20.8089	20.9617	20.9927	20.9912	20.9143	20.5775	20.0400	19.5379	(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	0.9417	0.9161	0.8642	0.7631	0.6010	0.3688	0.2043	0.2202	0.4838	0.7652	0.9018	0.9494	(89)
MIT 2	18.0796	18.3760	18.8588	19.3850	19.7510	19.9149	19.9342	19.9374	19.8753	19.4806	18.7495	18.0285	(90)
Living area fraction	18.4550	18.7291	19.1772	19.6682	20.0160	20.1771	20.1993	20.2014	20.1355	19.7554	19.0727	18.4066	(92)
MIT	18.3050	18.5791	19.0272	19.5182	19.8660	20.0271	20.0493	20.0514	19.9855	19.6054	18.9227	18.2566	(93)
Temperature adjustment													
adjusted MIT													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9229	0.8951	0.8424	0.7466	0.5969	0.3765	0.2155	0.2315	0.4879	0.7494	0.8806	0.9319	(94)
Useful gains	678.9532	738.8104	756.9483	722.9279	585.3797	370.7606	202.6816	211.2173	426.6373	597.9230	645.2895	646.1220	(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	1274.2711	1246.3906	1116.5672	917.2922	654.8089	380.8394	203.6748	212.4913	452.5659	760.1784	1037.2072	1257.5685	(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	442.9165	341.0939	267.5565	139.9423	51.6553	0.0000	0.0000	0.0000	0.0000	120.7180	282.1808	454.9162	(98)
Space heating												2100.9795	(98)
Space heating per m2												26.1576	(99)

(98) / (4) = 26.1576 (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													2321.5243 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.9165	341.0939	267.5565	139.9423	51.6553	0.0000	0.0000	0.0000	0.0000	120.7180	282.1808	454.9162	(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)	489.4105	376.8993	295.6425	154.6324	57.0777	0.0000	0.0000	0.0000	0.0000	133.3901	311.8019	502.6699	(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	89.7118	89.7209	89.7124	89.7601	89.6762	87.3000	87.3000	87.3000	87.3000	89.1595	89.5379	87.3000	(216)
(217)m	89.7118	89.7209	89.7124	89.7601	89.6762	87.3000	87.3000	87.3000	87.3000	89.1595	89.5379	87.3000	(217)
Fuel for water heating, kWh/month	155.6477	118.0182	93.9233	45.2287	19.2650	0.0000	0.0000	19.5389	46.1990	94.1595	130.7032	155.3377	(219)
Water heating fuel used												878.0213	(219)
Annual totals kWh/year													
Space heating fuel - main system												2321.5243	(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												1855.7518	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2321.5243	9.7400	226.1165	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	878.0213	9.7400	85.5193	(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			-79.5523	(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	2321.5243	0.2160	501.4493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	878.0213	0.2160	189.6526	(264)
Space and water heating			691.1019	(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			-6.3272 (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	2321.5243	1.2200	2832.2597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	878.0213	1.2200	1071.1860 (264)
Space and water heating			3903.4457 (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			-222.0015 (272)
Primary energy kWh/m2/year			-2.7640 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
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	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
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	3.6300	81.1852	0.4600	0.0000	0.9000	122.0067
South	4.6800	112.2060	0.4600	0.0000	0.9000	217.4014
West	2.4700	117.5071	0.4600	0.0000	0.9000	120.1604
South	3.3300	112.2060	0.4600	0.0000	0.9000	154.6894
total:						614.2579

	Jun	Jul	Aug	
Solar gains	645	614	572	(P4)
Internal gains	430	412	420	
Total summer gains	1075	1026	992	(P5)
Summer gain/loss ratio	3.25	3.10	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	20.21	21.96	21.76	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			