

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-631				Issued on Date	22/03/2023
Assessment Reference	Plot 631	Prop Type Ref	Islington-As-DET			
Property	Plot 631, 3 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.84	TER	18.84	
Environmental	85 B	% DER<TER	5.31			
CO ₂ Emissions (t/year)	1.49	DFEE	53.04	TFEE	60.32	
General Requirements Compliance	Pass	% DFEE<TFEE	12.07			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 101 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) 18.84 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (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 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North East: 7.68 m², No overhang
Windows facing South West: 8.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.029 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month										Total per year (kWh/year) =	Sum (64)m =	1730.0840 (64)
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	426.0099	423.7000	408.2077	383.1607	357.5269	333.0462	317.3011	323.7796	336.7949	362.0692	391.0739	413.0199 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.6800				11.2829		0.4600		0.0000		0.7700		30.6925 (75)	
Southwest	5.0200				36.7938		0.4600		0.0000		0.7700		65.4225 (79)	
Southwest	3.3300				36.7938		0.4600		0.0000		0.7700		43.3978 (79)	
Solar gains	139.5128	247.8367	366.1803	499.1040	600.4670	614.3480	584.7133	506.3060	411.7734	281.2137	168.9608	118.1926	(83)	
Total gains	565.5228	671.5368	774.3880	882.2647	957.9939	947.3942	902.0144	830.0856	748.5683	643.2829	560.0346	531.2125	(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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9910	0.9838	0.9683	0.9296	0.8496	0.7148	0.5738	0.6287	0.8319	0.9529	0.9852	0.9926 (86)
MIT	18.8679	19.1024	19.4913	20.0146	20.4777	20.8037	20.9307	20.9055	20.6464	20.4026	19.3719	18.8421 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9888	0.9799	0.9603	0.9107	0.8065	0.6296	0.4470	0.5042	0.7673	0.9367	0.9811	0.9909 (89)
MIT 2	16.9733	17.3166	17.8820	18.6398	19.2746	19.6883	19.8120	19.7971	19.5142	18.6942	17.7227	16.9450 (90)
Living area fraction									fLA =	Living area / (4) =		
MIT	17.3029	17.6272	18.1620	18.8789	19.4839	19.8823	20.0066	19.9899	19.7111	18.9287	18.0096	17.2750 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1529	17.4772	18.0120	18.7289	19.3339	19.7323	19.8566	19.8399	19.5611	18.7787	17.8596	17.1250 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9812	0.9683	0.9429	0.8872	0.7840	0.6198	0.4480	0.5028	0.7478	0.9156	0.9701	0.9844 (94)
Useful gains	554.8911	650.2774	730.2050	782.7298	751.0894	587.1889	404.1093	417.3880	559.7846	589.0033	543.2947	522.9182 (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												
	1750.4353	1706.2151	1555.7070	1304.2298	1009.4747	667.7390	423.7031	446.1896	715.0055	1081.5178	1432.7611	1733.6107 (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												
	889.4849	709.5902	614.1735	375.4800	192.2386	0.0000	0.0000	0.0000	0.0000	366.4308	640.4158	900.7552 (98)
Space heating												4688.5690 (98)
Space heating per m2										(98) / (4) =		46.5228 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												5180.7392 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	889.4849	709.5902	614.1735	375.4800	192.2386	0.0000	0.0000	0.0000	0.0000	366.4308	640.4158	900.7552 (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)	982.8562	784.0775	678.6448	414.8950	212.4184	0.0000	0.0000	0.0000	0.0000	404.8959	707.6418	995.3096 (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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Efficiency of water heater (217)m	89.9544	89.9103	89.8179	89.6023	89.1433	87.3000	87.3000	87.3000	87.3000	89.5619	89.8472	87.3000 (216)
Fuel for water heating, kWh/month	196.0402	171.9800	178.6914	157.6262	153.1140	136.5557	128.1658	144.7599	145.8047	163.6758	176.2016	190.2972 (219)
Water heating fuel used												1942.9127 (219)
Annual totals kWh/year												
Space heating fuel - main system												5180.7392 (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)												423.5919 (232)
Total delivered energy for all uses												7622.2437 (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	5180.7392	0.2160	1119.0397 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.9127	0.2160	419.6691 (264)
Space and water heating			1538.7088 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/year			1797.4780 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8400 (273)

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

DER		17.8400 ZC1
Total Floor Area	TFA	100.7800
Assumed number of occupants	N	2.7466
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.1457 ZC2
CO2 emissions from cooking, equation (L16)		1.8349 ZC3
Total CO2 emissions		34.8205 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		34.8205 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (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	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total = Sum(45)m =		1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (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)
Output from w/h	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Heat gains from water heating, kWh/month	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250 (72)
Total internal gains	438.3799	436.0741	420.5905	395.1201	368.8166	343.6684	327.9314	335.0769	348.7656	374.4631	403.4541	425.3940 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2			g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				7.6800	11.2829			0.6300	0.7000	0.7700	26.4823	
Southwest				8.3500	36.7938			0.6300	0.7000	0.7700	93.8930 (75)	
Solar gains	120.3753	213.8400	315.9499	430.6400	518.0986	530.0754	504.5059	436.8540	355.2888	242.6385	145.7838	101.9796 (83)
Total gains	558.7552	649.9141	736.5404	825.7601	886.9152	873.7439	832.4374	771.9310	704.0545	617.1016	549.2379	527.3737 (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	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026
util living area	0.9986	0.9968	0.9917	0.9732	0.9157	0.7806	0.6174	0.6777	0.8953	0.9843	0.9971	0.9989 (86)
MIT	19.5629	19.7203	19.9866	20.3519	20.6833	20.9052	20.9763	20.9635	20.7970	20.3697	19.9069	19.5447 (87)
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799 (88)
util rest of house	0.9980	0.9956	0.9885	0.9620	0.8782	0.6886	0.4792	0.5410	0.8337	0.9757	0.9958	0.9985 (89)
MIT 2	17.9547	18.1870	18.5773	19.1139	19.5690	19.8399	19.8973	19.8931	19.7278	19.1474	18.4715	17.9374 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	18.2345	18.4537	18.8224	19.3292	19.7628	20.0252	20.0850	20.0793	19.9137	19.3600	18.7212	18.2170 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2345	18.4537	18.8224	19.3292	19.7628	20.0252	20.0850	20.0793	19.9137	19.3600	18.7212	18.2170 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9969	0.9934	0.9841	0.9543	0.8728	0.6998	0.5031	0.5642	0.8346	0.9698	0.9937	0.9976 (94)
Ext temp.	557.0050	645.6371	724.8507	788.0508	774.1195	611.4664	418.8376	435.4933	587.5870	598.4397	545.8044	526.1150 (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	1779.8003	1725.1815	1563.1162	1301.7465	1003.3115	665.4754	427.4836	450.1142	717.1085	1090.0658	1455.0432	1766.2953 (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	909.7597	725.4538	623.6695	369.8609	170.5189	0.0000	0.0000	0.0000	0.0000	365.7698	654.6519	922.6941 (98)
Space heating per m2												4742.3788 (98)
												(98) / (4) = 47.0567 (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													5077.4933 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	909.7597	725.4538	623.6695	369.8609	170.5189	0.0000	0.0000	0.0000	0.0000	365.7698	654.6519	922.6941	(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)	974.0468	776.7172	667.7404	395.9967	182.5684	0.0000	0.0000	0.0000	0.0000	391.6165	700.9121	987.8952	(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	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
Efficiency of water heater (217)m	88.2919	88.1199	87.7471	86.8810	85.0576	80.3000	80.3000	80.3000	80.3000	86.7549	87.8737	80.3000	(216)
Fuel for water heating, kWh/month	241.4263	213.2201	224.9052	202.2076	199.9695	186.5567	178.7355	199.2482	201.4487	211.4873	220.7342	235.4606	(219)
Water heating fuel used												2515.3999	(219)
Annual totals kWh/year													
Space heating fuel - main system												5077.4933	(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)												423.5919	(232)
Total delivered energy for all uses												8091.4851	(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	5077.4933	0.2160	1096.7386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2515.3999	0.2160	543.3264 (264)
Space and water heating			1640.0649 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/m2/year			1898.8341 (272)
Emissions per m2 for space and water heating			16.2737 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1814 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2737 * 1.00) + 2.1814 + 0.3862, rounded to 2 d.p.			18.8400 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4040 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4040 (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	0.5152	0.5051	0.4950	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747 (22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	54.3927	53.9497	53.5155	51.4761	51.0946	49.3183	49.3183	48.9894	50.0025	51.0946	51.8665	52.6735 (38)
Heat transfer coeff	133.9196	133.4767	133.0425	131.0031	130.6215	128.8453	128.8453	128.5163	129.5294	130.6215	131.3934	132.2004 (39)
Average = Sum(39)m / 12 =												131.0013 (39)
HLP	1.3288	1.3244	1.3201	1.2999	1.2961	1.2785	1.2785	1.2752	1.2853	1.2961	1.3038	1.3118 (40)
HLP (average)												1.2999 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (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												
	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658 (72)
Total internal gains												
	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast		7.6800	11.2829	0.4600	0.0000	0.7700	30.6925 (75)
Southwest		5.0200	36.7938	0.4600	0.0000	0.7700	65.4225 (79)
Southwest		3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (79)

Solar gains	139.5128	247.8367	366.1803	499.1040	600.4670	614.3480	584.7133	506.3060	411.7734	281.2137	168.9608	118.1926 (83)
Total gains	531.6080	638.4551	743.0363	853.2677	930.5275	922.0807	878.5274	804.2547	721.9020	614.1798	528.1829	498.1273 (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	33.2500	33.3603	33.4692	33.9902	34.0895	34.5595	34.5595	34.6479	34.3769	34.0895	33.8892	33.6824
alpha	3.2167	3.2240	3.2313	3.2660	3.2726	3.3040	3.3040	3.3099	3.2918	3.2726	3.2593	3.2455
util living area												
	0.9925	0.9859	0.9713	0.9342	0.8561	0.7231	0.5818	0.6394	0.8413	0.9578	0.9875	0.9939 (86)
MIT	18.8625	19.0972	19.4865	20.0073	20.4728	20.8001	20.9294	20.9024	20.6379	20.0288	19.3578	18.8322 (87)
Th 2	19.8183	19.8217	19.8251	19.8409	19.8439	19.8577	19.8577	19.8603	19.8524	19.8439	19.8379	19.8316 (88)
util rest of house												
	0.9907	0.9825	0.9641	0.9165	0.8144	0.6389	0.4551	0.5152	0.7790	0.9430	0.9839	0.9925 (89)
MIT 2	17.8776	18.1132	18.5009	19.0205	19.4581	19.7459	19.8325	19.8219	19.6213	19.0517	18.3855	17.8569 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	18.0489	18.2844	18.6723	19.1921	19.6346	19.9292	20.0233	20.0098	19.7982	19.2217	18.5547	18.0265 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0489	18.2844	18.6723	19.1921	19.6346	19.9292	20.0233	20.0098	19.7982	19.2217	18.5547	18.0265 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9869	0.9764	0.9547	0.9040	0.8054	0.6448	0.4750	0.5333	0.7754	0.9324	0.9784	0.9893 (94)
Useful gains	524.6178	623.3883	709.3531	771.3282	749.4696	594.5658	417.3072	428.8748	559.7795	572.6760	516.7569	492.7757 (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												
	1841.2473	1786.5046	1619.4332	1348.2987	1036.4272	686.6472	441.0743	463.9199	738.0792	1126.1754	1505.0668	1827.8748 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	979.5723	781.6141	677.0996	415.4188	213.4965	0.0000	0.0000	0.0000	0.0000	411.8035	711.5831	993.3137 (98)
Space heating												5183.9017 (98)
Space heating per m2										(98) / (4) =		51.4378 (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	1211.1455	953.4549	976.7241	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7588	0.8283	0.7935	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	918.9907	789.7534	774.9976	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1183.6884	1130.5341	1045.7299	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	190.5823	253.5408	201.4249	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			645.5480 (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	47.6456	63.3852	50.3562	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												161.3870 (107)
Energy for space heating												1.6014 (108)
Energy for space cooling												51.4378 (99)
Total												1.6014 (108)
Dwelling Fabric Energy Efficiency (DFEE)												53.0392 (109)
												53.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (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	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m												1564.4598 (45)
Water 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 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Primary loss	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	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	(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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348	(73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	W
Northeast					7.6800	11.2829	0.6300		0.7000		0.7700	26.4823 (75)
Southwest					8.3500	36.7938	0.6300		0.7000		0.7700	93.8930 (79)
Solar gains	120.3753	213.8400	315.9499	430.6400	518.0986	530.0754	504.5059	436.8540	355.2888	242.6385	145.7838	101.9796 (83)
Total gains	512.4705	604.4584	692.8060	784.8036	848.1591	837.8082	798.3200	734.8027	665.4174	575.6047	505.0059	481.9144 (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	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395	
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026	
util living area	0.9990	0.9976	0.9935	0.9779	0.9267	0.7997	0.6388	0.7028	0.9114	0.9880	0.9979	0.9993 (86)	
MIT	19.5210	19.6794	19.9482	20.3187	20.6592	20.8941	20.9726	20.9573	20.7751	20.3343	19.8669	19.5033 (87)	
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799 (88)	
util rest of house	0.9986	0.9968	0.9910	0.9683	0.8925	0.7099	0.4982	0.5651	0.8557	0.9814	0.9971	0.9990 (89)	
MIT 2	18.5194	18.6802	18.9505	19.3283	19.6515	19.8546	19.8991	19.8960	19.7665	19.3496	18.8805	18.5123 (90)	
Living area fraction									fLA = Living area / (4) =			0.1739 (91)	
MIT	18.6936	18.8540	19.1240	19.5006	19.8268	20.0354	20.0858	20.0806	19.9419	19.5208	19.0521	18.6847 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6936	18.8540	19.1240	19.5006	19.8268	20.0354	20.0858	20.0806	19.9419	19.5208	19.0521	18.6847 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9981	0.9957	0.9886	0.9640	0.8901	0.7219	0.5229	0.5889	0.8583	0.9782	0.9961	0.9986 (94)	
Useful gains	511.5006	601.8422	684.9366	756.5124	754.9087	604.8441	417.4188	432.7518	571.1130	563.0713	503.0309	481.2379 (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	1838.4404	1776.1321	1601.3780	1323.1359	1011.2682	666.7318	427.5841	450.2698	720.5871	1110.0772	1496.4778	1825.2338 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)	
Space heating kWh	987.2432	789.1228	681.8324	407.9690	190.7315	0.0000	0.0000	0.0000	0.0000	406.9724	715.2818	999.9330 (98)	
Space heating												5179.0860 (98)	
Space heating per m2												51.3900 (99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1153.0466	907.7176	929.7567	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8017	0.8778	0.8428	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	924.3603	796.7562	783.6408	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.1881	1036.7851	964.5523	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	115.7960	178.5815	134.5982	0.0000	0.0000	0.0000	0.0000 (104)	
Space cooling												428.9757 (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	28.9490	44.6454	33.6495	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												107.2439 (107)
Space cooling per m2												1.0641 (108)
Energy for space heating												51.3900 (99)
Energy for space cooling												1.0641 (108)
Total												52.4542 (109)
Target Fabric Energy Efficiency (TFEE)												60.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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)
Output from w/h	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
RHI water heating demand												1730 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.6800	12.9236		0.4600		0.0000		0.7700		35.1554 (75)
Southwest				5.0200	40.4699		0.4600		0.0000		0.7700		71.9589 (79)
Southwest				3.3300	40.4699		0.4600		0.0000		0.7700		47.7337 (79)
Solar gains	154.8480	248.1414	363.9151	514.0363	604.5339	662.6011	623.5632	550.8511	444.6071	301.1169	192.2425	129.8476	(83)
Total gains	788.6648	876.9421	967.9384	1079.6365	1130.6173	1153.5340	1094.1531	1030.6256	946.6821	841.8423	775.8555	746.0766	(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)												
tau	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area	0.9736	0.9617	0.9327	0.8631	0.7329	0.5176	0.3560	0.3858	0.6687	0.8842	0.9562	0.9772 (86)
MIT	19.3308	19.5221	19.8940	20.3581	20.7358	20.9440	20.9885	20.9851	20.8595	20.4077	19.8168	19.3087 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house	0.9676	0.9531	0.9169	0.8301	0.6677	0.4141	0.2289	0.2542	0.5728	0.8484	0.9446	0.9720 (89)
MIT 2	17.6641	17.9429	18.4733	19.1207	19.6034	19.8298	19.8569	19.8612	19.7590	19.2069	18.3805	17.6407 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.9540	18.2176	18.7204	19.3359	19.8004	20.0236	20.0537	20.0567	19.9504	19.4158	18.6304	17.9308 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8040	18.0676	18.5704	19.1859	19.6504	19.8736	19.9037	19.9067	19.8004	19.2658	18.4804	17.7808 (93)

8. Space heating requirement

Utilisation	0.9523	0.9346	0.8940	0.8069	0.6548	0.4152	0.2340	0.2592	0.5669	0.8250	0.9250	0.9581 (94)
Useful gains	751.0787	819.6029	865.3293	871.1610	740.2919	478.9506	256.0135	267.1183	536.6723	694.5291	717.6360	714.8075 (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	1674.2372	1632.3386	1462.4978	1204.4926	862.6266	496.7430	257.6634	269.4367	589.9549	988.5348	1351.4850	1649.8512 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	686.8299	546.1584	444.2933	239.9987	91.0170	0.0000	0.0000	0.0000	0.0000	218.7402	456.3713	695.6725 (98)
Space heating												3379.0813 (98)
RHI space heating demand												3379 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.6800	11.2829		0.4600		0.0000		0.7700		30.6925 (75)
Southwest				5.0200	36.7938		0.4600		0.0000		0.7700		65.4225 (79)
Southwest				3.3300	36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	139.5128	247.8367	366.1803	499.1040	600.4670	614.3480	584.7133	506.3060	411.7734	281.2137	168.9608	118.1926	(83)
Total gains	773.3296	876.6375	970.2036	1064.7042	1126.5505	1105.2809	1055.3033	986.0806	913.8484	821.9391	752.5738	734.4215	(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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9784	0.9667	0.9437	0.8919	0.7968	0.6490	0.5065	0.5533	0.7612	0.9147	0.9668	0.9815 (86)
MIT	19.1119	19.3350	19.6980	20.1771	20.5828	20.8543	20.9521	20.9354	20.7383	20.2170	19.5923	19.0840 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9736	0.9593	0.9308	0.8660	0.7463	0.5621	0.3883	0.4348	0.6862	0.8887	0.9582	0.9773 (89)
MIT 2	17.3263	17.6503	18.1731	18.8577	19.4000	19.7341	19.8242	19.8161	19.6116	18.9295	18.0379	17.2955 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	17.6369	17.9434	18.4384	19.0872	19.6057	19.9289	20.0204	20.0108	19.8076	19.1535	18.3083	17.6066 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4869	17.7934	18.2884	18.9372	19.4557	19.7789	19.8704	19.8608	19.6576	19.0035	18.1583	17.4566 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9597	0.9416	0.9085	0.8414	0.7274	0.5563	0.3907	0.4359	0.6723	0.8645	0.9406	0.9649 (94)
Useful gains	742.1925	825.4636	881.3988	895.8459	819.4107	614.8896	412.3374	429.8686	614.3789	710.5426	707.8457	708.6433 (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												
	1795.9204	1749.1041	1593.0643	1331.8632	1025.5817	673.8103	425.4942	448.9050	727.6288	1111.2379	1472.5292	1778.0891 (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												
	783.9736	620.6865	529.4792	313.9325	153.3913	0.0000	0.0000	0.0000	0.0000	298.1173	550.5721	795.6676 (98)
Space heating												4045.8201 (98)
Space heating per m2										(98) / (4) =		40.1451 (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												4470.5194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	783.9736	620.6865	529.4792	313.9325	153.3913	0.0000	0.0000	0.0000	0.0000	298.1173	550.5721	795.6676 (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)	866.2692	685.8414	585.0599	346.8867	169.4931	0.0000	0.0000	0.0000	0.0000	329.4114	608.3670	879.1907 (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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Efficiency of water heater (217)m	89.8949	89.8432	89.7349	89.4822	88.9646	87.3000	87.3000	87.3000	87.3000	89.4196	89.7652	87.3000 (216)
Fuel for water heating, kWh/month	196.1700	172.1085	178.8567	157.8377	153.4216	136.5557	128.1658	144.7599	145.8047	163.9365	176.3627	190.4176 (219)
Water heating fuel used												1944.3974 (219)
Annual totals kWh/year												
Space heating fuel - main system												4470.5194 (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)												423.5919 (232)
Total delivered energy for all uses												6913.5087 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4470.5194	3.4800	155.5741 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.3974	3.4800	67.6650 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	423.5919	13.1900	55.8718 (250)
Additional standing charges			120.0000 (251)
Total energy cost			409.0034 (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] =	1.1784 (257)
SAP value		83.5619
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	4470.5194	0.2160	965.6322 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.3974	0.2160	419.9898 (264)
Space and water heating			1385.6220 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1644.3912 (272)
CO2 emissions per m2			16.3200 (273)
EI value			84.8849
EI rating			85 (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	$3.48 / 0.8885 = 3.917$, stars = 4
Water heating environmental impact	$0.216 / 0.8885 = 0.2431$, 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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month										Total per year (kWh/year) =	Sum (64)m =	1730.0840 (64)
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.6800	12.9236	0.4600	0.0000	0.7700	35.1554 (75)			
Southwest				5.0200	40.4699	0.4600	0.0000	0.7700	71.9589 (79)			
Southwest				3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (79)			
Solar gains	154.8480	248.1414	363.9151	514.0363	604.5339	662.6011	623.5632	550.8511	444.6071	301.1169	192.2425	129.8476 (83)
Total gains	788.6648	876.9421	967.9384	1079.6365	1130.6173	1153.5340	1094.1531	1030.6256	946.6821	841.8423	775.8555	746.0766 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area												
	0.9736	0.9617	0.9327	0.8631	0.7329	0.5176	0.3560	0.3858	0.6687	0.8842	0.9562	0.9772 (86)
MIT	19.3308	19.5221	19.8940	20.3581	20.7358	20.9440	20.9885	20.9851	20.8595	20.4077	19.8168	19.3087 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house												
	0.9676	0.9531	0.9169	0.8301	0.6677	0.4141	0.2289	0.2542	0.5728	0.8484	0.9446	0.9720 (89)
MIT 2	17.6641	17.9429	18.4733	19.1207	19.6034	19.8298	19.8569	19.8612	19.7590	19.2069	18.3805	17.6407 (90)
Living area fraction												
	fLA = Living area / (4) =											0.1739 (91)
MIT	17.9540	18.2176	18.7204	19.3359	19.8004	20.0236	20.0537	20.0567	19.9504	19.4158	18.6304	17.9308 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8040	18.0676	18.5704	19.1859	19.6504	19.8736	19.9037	19.9067	19.8004	19.2658	18.4804	17.7808 (93)

8. Space heating requirement

Utilisation	0.9523	0.9346	0.8940	0.8069	0.6548	0.4152	0.2340	0.2592	0.5669	0.8250	0.9250	0.9581 (94)
Useful gains	751.0787	819.6029	865.3293	871.1610	740.2919	478.9506	256.0135	267.1183	536.6723	694.5291	717.6360	714.8075 (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												
	1674.2372	1632.3386	1462.4978	1204.4926	862.6266	496.7430	257.6634	269.4367	589.9549	988.5348	1351.4850	1649.8512 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	686.8299	546.1584	444.2933	239.9987	91.0170	0.0000	0.0000	0.0000	0.0000	218.7402	456.3713	695.6725 (98)
Space heating												3379.0813 (98)
Space heating per m2												(98) / (4) = 33.5293 (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													3733.7915 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	686.8299	546.1584	444.2933	239.9987	91.0170	0.0000	0.0000	0.0000	0.0000	218.7402	456.3713	695.6725	(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)	758.9281	603.4899	490.9319	265.1919	100.5713	0.0000	0.0000	0.0000	0.0000	241.7019	504.2776	768.6989	(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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8273	89.7739	89.6281	89.2875	88.5526	87.3000	87.3000	87.3000	87.3000	89.1882	89.6536	87.3000	(216)
Fuel for water heating, kWh/month	196.3176	172.2413	179.0697	158.1819	154.1353	136.5557	128.1658	144.7599	145.8047	164.3617	176.5821	190.5593	(219)
Water heating fuel used												1946.7351	(219)
Annual totals kWh/year													
Space heating fuel - main system												3733.7915	(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)												423.5919	(232)
Total delivered energy for all uses												6179.1185	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3733.7915	9.7400	363.6713 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.7351	9.7400	189.6120 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	423.5919	36.8500	156.0936 (250)
Additional standing charges			104.0000 (251)
Total energy cost			841.0144 (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	3733.7915	0.2160	806.4990 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.7351	0.2160	420.4948 (264)
Space and water heating			1226.9937 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1485.7629 (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	3733.7915	1.2200	4555.2257 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.7351	1.2200	2375.0168 (264)
Space and water heating			6930.2425 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Primary energy kWh/year			8460.9195 (272)
Primary energy kWh/m2/year			83.9544 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 85

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	+ 1.1	-£ 79	-189 kg (12.8%)
U Solar photovoltaic panels	+ 9.2	-£ 672	-947 kg (73.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	1.88 kg/m ²	B 85 B 87
Solar photovoltaic panels	£672	9.39 kg/m ²	A 94 A 95
Total Savings	£751	11.27 kg/m ²	

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 95

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	£184	£202	-£18
Mains gas	£657	£560	£97
Space heating	£495	£495	£0
Water heating	£190	£111	£79
Lighting	£156	£156	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£841	£90	£751
Total cost of uses	£841	£90	£751
Delivered energy	61 kWh/m ²	34 kWh/m ²	28 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	3 kg/m ²	11 kg/m ²
Primary energy	84 kWh/m ²	18 kWh/m ²	66 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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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												1.1593 (H8)
Utilisation factor												0.5779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-869.6671 (H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037 (63)
Solar input (sum of months) = Sum (63)m =												-869.6671 (63)
Output from w/h	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129 (64)
Total per year (kWh/year) = Sum (64)m =												863.6545 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				7.6800	11.2829		0.4600		0.0000		0.7700		30.6925 (75)
Southwest				5.0200	36.7938		0.4600		0.0000		0.7700		65.4225 (79)
Southwest				3.3300	36.7938		0.4600		0.0000		0.7700		43.3978 (79)
Solar gains	139.5128	247.8367	366.1803	499.1040	600.4670	614.3480	584.7133	506.3060	411.7734	281.2137	168.9608	118.1926	(83)
Total gains	773.3296	876.6375	970.2036	1064.7042	1126.5505	1105.2809	1055.3033	986.0806	913.8484	821.9391	752.5738	734.4215	(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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area	0.9784	0.9667	0.9437	0.8919	0.7968	0.6490	0.5065	0.5533	0.7612	0.9147	0.9668	0.9815 (86)
MIT	19.1119	19.3350	19.6980	20.1771	20.5828	20.8543	20.9521	20.9354	20.7383	20.2170	19.5923	19.0840 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house	0.9736	0.9593	0.9308	0.8660	0.7463	0.5621	0.3883	0.4348	0.6862	0.8887	0.9582	0.9773 (89)
MIT 2	17.3263	17.6503	18.1731	18.8577	19.4000	19.7341	19.8242	19.8161	19.6116	18.9295	18.0379	17.2955 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.6369	17.9434	18.4384	19.0872	19.6057	19.9289	20.0204	20.0108	19.8076	19.1535	18.3083	17.6066 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4869	17.7934	18.2884	18.9372	19.4557	19.7789	19.8704	19.8608	19.6576	19.0035	18.1583	17.4566 (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	0.9597	0.9416	0.9085	0.8414	0.7274	0.5563	0.3907	0.4359	0.6723	0.8645	0.9406	0.9649	(94)
Useful gains	742.1925	825.4636	881.3988	895.8459	819.4107	614.8896	412.3374	429.8686	614.3789	710.5426	707.8457	708.6433	(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	1795.9204	1749.1041	1593.0643	1331.8632	1025.5817	673.8103	425.4942	448.9050	727.6288	1111.2379	1472.5292	1778.0891	(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	783.9736	620.6865	529.4792	313.9325	153.3913	0.0000	0.0000	0.0000	0.0000	298.1173	550.5721	795.6676	(98)
Space heating												4045.8201	(98)
Space heating per m2											(98) / (4) =	40.1451	(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													4470.5194	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	783.9736	620.6865	529.4792	313.9325	153.3913	0.0000	0.0000	0.0000	0.0000	298.1173	550.5721	795.6676	(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)	866.2692	685.8414	585.0599	346.8867	169.4931	0.0000	0.0000	0.0000	0.0000	329.4114	608.3670	879.1907	(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	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129	(64)	
Efficiency of water heater	89.9670	89.9937	90.0259	90.0845	90.1560	87.3000	87.3000	87.3000	87.3000	89.7193	89.8770	87.3000	(216)	
Fuel for water heating, kWh/month	167.9818	125.0590	98.6664	50.1559	19.7705	2.9152	0.0000	29.5406	55.5649	103.4272	142.8612	166.8356	(219)	
Water heating fuel used												962.7785	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4470.5194	(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)													423.5919	(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												4254.6504	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4470.5194	3.4800	155.5741	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.7785	3.4800	33.5047	(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	423.5919	13.1900	55.8718	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			153.6152	(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] =	0.4426	(257)
SAP value			93.8261	
SAP rating (Section 12)			94	(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	4470.5194	0.2160	965.6322 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.7785	0.2160	207.9602 (264)
Space and water heating			1173.5923 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			561.8743 (272)
CO2 emissions per m2			5.5800 (273)
EI value			94.8353
EI rating			95 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (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)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

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)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2243 (H8)
Utilisation factor												0.5582 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-887.0104 (H17)
Solar input	-27.3017	-41.0345	-69.1072	-95.5273	-115.0470	-121.0820	-118.1746	-105.5306	-82.3670	-56.0328	-33.1860	-22.6197 (63)
Solar input (sum of months) = Sum (63)m =												-887.0104 (63)
Output from w/h	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969 (64)
Total per year (kWh/year) = Sum (64)m =												851.2283 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.6800	12.9236	0.4600	0.0000	0.7700	35.1554 (75)			
Southwest				5.0200	40.4699	0.4600	0.0000	0.7700	71.9589 (79)			
Southwest				3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (79)			
Solar gains	154.8480	248.1414	363.9151	514.0363	604.5339	662.6011	623.5632	550.8511	444.6071	301.1169	192.2425	129.8476 (83)
Total gains	788.6648	876.9421	967.9384	1079.6365	1130.6173	1153.5340	1094.1531	1030.6256	946.6821	841.8423	775.8555	746.0766 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246	
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816	
util living area	0.9736	0.9617	0.9327	0.8631	0.7329	0.5176	0.3560	0.3858	0.6687	0.8842	0.9562	0.9772	(86)
MIT	19.3308	19.5221	19.8940	20.3581	20.7358	20.9440	20.9885	20.9851	20.8595	20.4077	19.8168	19.3087	(87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479	(88)
util rest of house	0.9676	0.9531	0.9169	0.8301	0.6677	0.4141	0.2289	0.2542	0.5728	0.8484	0.9446	0.9720	(89)
MIT 2	17.6641	17.9429	18.4733	19.1207	19.6034	19.8298	19.8569	19.8612	19.7590	19.2069	18.3805	17.6407	(90)
Living area fraction									fLA = Living area / (4) =			0.1739	(91)
MIT	17.9540	18.2176	18.7204	19.3359	19.8004	20.0236	20.0537	20.0567	19.9504	19.4158	18.6304	17.9308	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8040	18.0676	18.5704	19.1859	19.6504	19.8736	19.9037	19.9067	19.8004	19.2658	18.4804	17.7808	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9523	0.9346	0.8940	0.8069	0.6548	0.4152	0.2340	0.2592	0.5669	0.8250	0.9250	0.9581	(94)
Useful gains	751.0787	819.6029	865.3293	871.1610	740.2919	478.9506	256.0135	267.1183	536.6723	694.5291	717.6360	714.8075	(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	1674.2372	1632.3386	1462.4978	1204.4926	862.6266	496.7430	257.6634	269.4367	589.9549	988.5348	1351.4850	1649.8512	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	686.8299	546.1584	444.2933	239.9987	91.0170	0.0000	0.0000	0.0000	0.0000	218.7402	456.3713	695.6725	(98)
Space heating												3379.0813	(98)
Space heating per m2												(98) / (4) =	33.5293 (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													3733.7915 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	686.8299	546.1584	444.2933	239.9987	91.0170	0.0000	0.0000	0.0000	0.0000	218.7402	456.3713	695.6725	(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)	758.9281	603.4899	490.9319	265.1919	100.5713	0.0000	0.0000	0.0000	0.0000	241.7019	504.2776	768.6989	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969	(64)
Efficiency of water heater	89.9123	89.9324	89.9376	89.9724	89.8719	87.3000	87.3000	87.3000	87.3000	89.5391	89.7918	87.3000	(216)
(217)m	89.9123	89.9324	89.9376	89.9724	89.8719	87.3000	87.3000	87.3000	87.3000	89.5391	89.7918	89.9199	(217)
Fuel for water heating, kWh/month	165.7672	126.3097	101.6145	50.8038	23.8605	0.0000	0.0000	23.8772	51.4554	101.1386	139.3516	165.2548	(219)
Water heating fuel used												949.4331	(219)
Annual totals kWh/year													
Space heating fuel - main system												3733.7915	(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)												423.5919	(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												3407.6569	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3733.7915	9.7400	363.6713	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.4331	9.7400	92.4748	(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	423.5919	36.8500	156.0936	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			90.0994	(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	3733.7915	0.2160	806.4990	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.4331	0.2160	205.0776	(264)
Space and water heating			1011.5765	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	423.5919	0.5190	219.8442	(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			349.5569 (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	3733.7915	1.2200	4555.2257 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.4331	1.2200	1158.3084 (264)
Space and water heating			5713.5341 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1797.5410 (272)
Primary energy kWh/m2/year			17.8363 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	159.1 (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	343.88 (P1)
Transmission heat loss coefficient	79.53 (37)
Summer heat loss coefficient	423.41 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	7.6800	98.8453	0.4600	0.0000	0.9000	314.2805
South West	5.0200	119.9223	0.4600	0.0000	0.9000	249.2322
South West	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273
total:						728.8401

	Jun	Jul	Aug	
Solar gains	774	729	644	(P4)
Internal gains	488	468	477	
Total summer gains	1262	1196	1121	(P5)
Summer gain/loss ratio	2.98	2.83	2.65	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 159.1)	0.89	0.89	0.89	
Threshold temperature	19.87	21.61	21.33	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			