

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-597				Issued on Date	22/03/2023
Assessment Reference	Plot 597	Prop Type Ref	Dawlish-As-DET			
Property	Plot 597, 3 Bed, K, WC, Ut, B, En					
SAP Rating	83 B	DER	18.66	TER	19.42	
Environmental	84 B	% DER<TER	3.94			
CO ₂ Emissions (t/year)	1.50	DFEE	55.83	TFEE	63.26	
General Requirements Compliance	Pass	% DFEE<TFEE	11.75			
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 97 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) 19.42 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.66 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)63.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.8 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: 6.71 m², No overhang

Windows facing East: 5.95 m², No overhang

Windows facing South: 1.31 m², No overhang

Windows facing South West: 1.03 m², No overhang

Windows facing West: 5.25 m², No overhang

Windows facing North West: 1.03 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 0.035 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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	251.1416 (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) =	0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =		0.4496 (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	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283 (22b)
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	55.0546	54.5259	54.0076	51.5733	51.1179	48.9977	48.9977	48.6051	49.8144	51.1179	52.0393	53.0025 (38)
Average = Sum(39)m / 12 =	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
												136.9449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4424	1.4369	1.4316	1.4066	1.4019	1.3802	1.3802	1.3761	1.3885	1.4019	1.4114	1.4213 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (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
	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4777	19.9645	16.2362	12.2919	9.1883	7.7572	8.3819	10.8951	14.6234	18.5677	21.6713	23.1024 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685 (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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	417.8424	415.6611	400.6028	376.1820	351.1829	327.2146	311.7142	318.0311	330.6319	355.2780	383.6216	405.0753 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	10.6334	0.4600	0.0000	0.7700	25.2722 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	1.3100	46.7521	0.4600	0.0000	0.7700	21.6931 (78)
Southwest	1.0300	36.7938	0.4600	0.0000	0.7700	13.4233 (79)
West	5.2500	19.6403	0.4600	0.0000	0.7700	36.5221 (80)
Northwest	1.0300	11.2829	0.4600	0.0000	0.7700	4.1163 (81)
East	3.3300	19.6403	0.4600	0.0000	0.7700	23.1654 (76)

Solar gains	142.4186	267.4836	424.7112	612.6046	756.2628	779.2931	739.6336	629.6444	490.1480	312.1749	175.2969	118.7346 (83)
Total gains	560.2610	683.1447	825.3140	988.7867	1107.4457	1106.5077	1051.3478	947.6755	820.7799	667.4528	558.9184	523.8099 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
util living area	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
	0.9933	0.9865	0.9691	0.9205	0.8207	0.6678	0.5247	0.5888	0.8190	0.9567	0.9885	0.9946 (86)
MIT	18.9208	19.1630	19.5771	20.1250	20.5771	20.8573	20.9534	20.9312	20.6935	20.0841	19.4111	18.8936 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house	0.9915	0.9829	0.9606	0.8977	0.7686	0.5736	0.3948	0.4572	0.7454	0.9399	0.9848	0.9932 (89)
MIT 2	16.9874	17.3420	17.9430	18.7298	19.3339	19.6731	19.7578	19.7475	19.5050	18.6914	17.7173	16.9571 (90)
Living area fraction	17.3794	17.7112	18.2743	19.0127	19.5860	19.9132	20.0002	19.9875	19.7460	18.9737	18.0607	17.3497 (92)
MIT	17.3794	17.7112	18.2743	19.0127	19.5860	19.9132	20.0002	19.9875	19.7460	18.9737	18.0607	17.3497 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2294	17.5612	18.1243	18.8627	19.4360	19.7632	19.8502	19.8375	19.5960	18.8237	17.9107	17.1997 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9857	0.9734	0.9447	0.8764	0.7524	0.5723	0.4030	0.4638	0.7324	0.9216	0.9761	0.9884 (94)
Ext temp.	552.2363	664.9501	779.7102	866.5301	833.2475	633.2880	423.6606	439.5163	601.1790	615.0935	545.5823	517.7309 (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	1815.6550	1771.2982	1620.2067	1364.3592	1055.8925	693.7877	436.7397	460.5481	742.9932	1122.4717	1485.5357	1798.8562 (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)
	939.9835	743.4659	625.3294	358.4370	165.6479	0.0000	0.0000	0.0000	0.0000	377.4893	676.7664	953.1573 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 4840.2768 (98)
49.7153 (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													5348.3722 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	939.9835	743.4659	625.3294	358.4370	165.6479	0.0000	0.0000	0.0000	0.0000	377.4893	676.7664	953.1573	(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)	1038.6558	821.5093	690.9717	396.0630	183.0364	0.0000	0.0000	0.0000	0.0000	417.1153	747.8082	1053.2125	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater (217)m	89.9821	89.9358	89.8313	89.5767	89.0315	87.3000	87.3000	87.3000	87.3000	89.5862	89.8791	90.0007	(216)
Fuel for water heating, kWh/month	194.5588	170.6878	177.3800	156.5456	152.2198	135.5997	127.2799	143.7432	144.7757	162.4654	174.8705	188.8633	(219)
Water heating fuel used												1928.9896	(219)
Annual totals kWh/year													
Space heating fuel - main system												5348.3722	(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)												396.9635	(232)
Total delivered energy for all uses												7749.3253	(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	5348.3722	0.2160	1155.2484	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1928.9896	0.2160	416.6618	(264)
Space and water heating			1571.9101	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total CO2, kg/year			1816.8592	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.6600	(273)

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

DER	18.6600	ZC1
Total Floor Area	97.3600	TFA
Assumed number of occupants	2.7137	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.3372	ZC2
CO2 emissions from cooking, equation (L16)	1.8912	ZC3
Total CO2 emissions	35.8884	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	35.8884	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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1195 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3695 (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) =	0.3695 (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	0.4711	0.4618	0.4526	0.4064	0.3972	0.3510	0.3510	0.3417	0.3695	0.3972	0.4156	0.4341 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5682	0.5789	0.5864	0.5942 (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 (U _w = 1.40)			20.0900	1.3258	26.6345		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051		(28a)
EW Brick AAC015	147.0400	24.3500	122.6900	0.1800	22.0842		(29a)
Plane Ceiling	48.0900		48.0900	0.1300	6.2517		(30)
Bay	1.1800		1.1800	0.1300	0.1534		(30)
Total net area of external elements A _{um} (A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2149		(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)							12.3682 (36)
Total fabric heat loss						(33) + (36) =	78.5831 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	50.6332	50.2762	49.9262	48.2824	47.9748	46.5431	46.5431	46.2779	47.0946	47.9748	48.5970	49.2475 (38)
Heat transfer coeff	129.2163	128.8592	128.5093	126.8654	126.5579	125.1262	125.1262	124.8610	125.6776	126.5579	127.1801	127.8305 (39)
Average = Sum(39)m / 12 =												126.8640 (39)
HLP	1.3272	1.3235	1.3199	1.3031	1.2999	1.2852	1.2852	1.2825	1.2909	1.2999	1.3063	1.3130 (40)
HLP (average)												1.3030 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Daily hot water use	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy conte	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1552.1566 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (46)	
Water storage loss:												
Total storage loss												

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 (56)
Combi loss	50.9589	46.0274	50.9589	47.6766	47.2549	43.7846	45.2441	47.2549	47.6766	50.9589	49.3151	50.9589 (57)
Total heat required for water heating calculated for each month	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066 (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	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066 (64)
Heat gains from water heating, kWh/month	66.2474	58.3050	61.0313	54.0209	52.2113	45.8062	43.6140	48.8819	49.4300	56.4550	60.0474	64.5591 (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	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5569	20.0348	16.2934	12.3351	9.2207	7.7845	8.4114	10.9335	14.6749	18.6331	21.7476	23.1838	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	89.0423	86.7634	82.0313	75.0290	70.1765	63.6197	58.6210	65.7014	68.6528	75.8804	83.3992	86.7730	(72)
Total internal gains	430.2925	428.1065	413.0436	388.0552	362.3805	337.7448	322.2546	329.2423	342.5243	367.7381	396.0791	417.5318	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.3400	10.6334		0.6300		0.7000		0.7700		20.6031 (74)
East				5.6200	19.6403		0.6300		0.7000		0.7700		33.7330 (76)
South				1.2400	46.7521		0.6300		0.7000		0.7700		17.7172 (78)
Southwest				0.9700	36.7938		0.6300		0.7000		0.7700		10.9073 (79)
West				4.9500	19.6403		0.6300		0.7000		0.7700		29.7115 (80)
Northwest				0.9700	11.2829		0.6300		0.7000		0.7700		3.3448 (81)
Solar gains	116.0169	217.8883	345.9473	498.9796	615.9855	634.7428	602.4400	512.8558	399.2425	254.2882	142.7984		96.7246 (83)
Total gains	546.3094	645.9948	758.9909	887.0348	978.3661	972.4876	924.6946	842.0981	741.7668	622.0263	538.8775		514.2564 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3240	52.4690	52.6119	53.2936	53.4231	54.0344	54.0344	54.1491	53.7973	53.4231	53.1617	52.8912	
alpha	4.4883	4.4979	4.5075	4.5529	4.5615	4.6023	4.6023	4.6099	4.5865	4.5615	4.5441	4.5261	
util living area	0.9984	0.9964	0.9896	0.9635	0.8869	0.7338	0.5720	0.6400	0.8787	0.9825	0.9969	0.9988	(86)
MIT	19.4932	19.6619	19.9593	20.3615	20.7096	20.9179	20.9796	20.9666	20.7974	20.3379	19.8458	19.4693	(87)
Th 2	19.8196	19.8224	19.8252	19.8384	19.8409	19.8525	19.8525	19.8546	19.8480	19.8409	19.8359	19.8307	(88)
util rest of house	0.9979	0.9951	0.9856	0.9487	0.8407	0.6352	0.4344	0.5005	0.8100	0.9729	0.9955	0.9984	(89)
MIT 2	17.8210	18.0693	18.5037	19.0877	19.5552	19.7980	19.8452	19.8410	19.6805	19.0648	18.3477	17.7936	(90)
Living area fraction	18.1601	18.3922	18.7988	19.3460	19.7893	20.0251	20.0752	20.0692	19.9070	19.3229	18.6515	18.1334	(91)
MIT	18.1601	18.3922	18.7988	19.3460	19.7893	20.0251	20.0752	20.0692	19.9070	19.3229	18.6515	18.1334	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1601	18.3922	18.7988	19.3460	19.7893	20.0251	20.0752	20.0692	19.9070	19.3229	18.6515	18.1334	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	544.4657	641.2480	744.2722	834.1953	820.1428	633.5922	427.5808	445.0877	603.9903	601.3432	535.2846	512.9327	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1790.9455	1738.5970	1580.5117	1325.2313	1023.7590	678.8163	434.8376	458.1417	729.8056	1103.9549	1469.1170	1781.1082	(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	927.3810	737.4185	622.1622	353.5460	151.4904	0.0000	0.0000	0.0000	0.0000	373.9431	672.3593	943.5226	(98)
Space heating												4781.8231	(98)
Space heating per m2												49.1149	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5119.7249 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	927.3810	737.4185	622.1622	353.5460	151.4904	0.0000	0.0000	0.0000	0.0000	373.9431	672.3593	943.5226	(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)	992.9133	789.5273	666.1265	378.5289	162.1953	0.0000	0.0000	0.0000	0.0000	400.3674	719.8708	1010.1955	(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	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066	(64)
Efficiency of water heater (217)m	88.3336	88.1591	87.7538	86.7951	84.7808	80.3000	80.3000	80.3000	80.3000	86.8194	87.9349	88.4010	(216)
Fuel for water heating, kWh/month	239.8682	211.8600	223.5761	200.8158	199.0445	185.0896	177.3299	197.6813	199.8645	210.1298	219.2869	233.9414	(219)
Water heating fuel used												2498.4879	(219)
Annual totals kWh/year													
Space heating fuel - main system												5119.7249	(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)												398.3610	(232)
Total delivered energy for all uses												8091.5739	(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	5119.7249	0.2160	1105.8606 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2498.4879	0.2160	539.6734 (264)
Space and water heating			1645.5340 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.3610	0.5190	206.7494 (268)
Total CO2, kg/m2/year			1891.2084 (272)
Emissions per m2 for space and water heating			16.9015 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1236 (272b)
Emissions per m2 for pumps and fans			0.3998 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.9015 * 1.00) + 2.1236 + 0.3998, rounded to 2 d.p.			19.4200 (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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =		0.1195 (8)	
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3700 (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) =				0.3700 (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	0.4717	0.4624	0.4532	0.4069	0.3977	0.3515	0.3515	0.3422	0.3700	0.3977	0.4162	0.4347 (22b)					
Effective ac	0.6112	0.6069	0.6027	0.5828	0.5791	0.5618	0.5618	0.5586	0.5684	0.5791	0.5866	0.5945 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (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	50.6581	50.3001	49.9492	48.3009	47.9925	46.5569	46.5569	46.2911	47.1099	47.9925	48.6164	49.2686 (38)
Heat transfer coeff	136.0318	135.6738	135.3229	133.6746	133.3662	131.9306	131.9306	131.6648	132.4836	133.3662	133.9901	134.6423 (39)
Average = Sum(39)m / 12 =												133.6731 (39)
HLP	1.3972	1.3935	1.3899	1.3730	1.3698	1.3551	1.3551	1.3523	1.3608	1.3698	1.3762	1.3829 (40)
HLP (average)												1.3730 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	34.1967	29.9086	30.8630	26.9071	25.8180	22.2790	20.6448	23.6902	23.9731	27.9383	30.4969	33.1176 (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	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4777	19.9645	16.2362	12.2919	9.1883	7.7572	8.3819	10.8951	14.6234	18.5677	21.6713	23.1024	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	45.9632	44.5069	41.4825	37.3710	34.7016	30.9430	27.7483	31.8416	33.2960	37.5515	42.3568	44.5130	(72)
Total internal gains	384.1344	382.7796	369.4377	347.3539	323.8733	302.0408	288.3524	292.3441	304.1161	326.3439	351.9604	372.1904	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					6.7100	10.6334	0.4600	0.0000			0.7700			25.2722 (74)
East					2.6200	19.6403	0.4600	0.0000			0.7700			18.2262 (76)
South					1.3100	46.7521	0.4600	0.0000			0.7700			21.6931 (78)
Southwest					1.0300	36.7938	0.4600	0.0000			0.7700			13.4233 (79)
West					5.2500	19.6403	0.4600	0.0000			0.7700			36.5221 (80)
Northwest					1.0300	11.2829	0.4600	0.0000			0.7700			4.1163 (81)
East					3.3300	19.6403	0.4600	0.0000			0.7700			23.1654 (76)
Solar gains	142.4186	267.4836	424.7112	612.6046	756.2628	779.2931	739.6336	629.6444	490.1480	312.1749	175.2969	118.7346	(83)	
Total gains	526.5530	650.2632	794.1489	959.9585	1080.1361	1081.3339	1027.9860	921.9885	794.2640	638.5187	527.2572	490.9250	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.6561	35.7502	35.8429	36.2849	36.3688	36.7645	36.7645	36.8388	36.6111	36.3688	36.1994	36.0241	
alpha	3.3771	3.3833	3.3895	3.4190	3.4246	3.4510	3.4510	3.4559	3.4407	3.4246	3.4133	3.4016	
util living area	0.9945	0.9883	0.9717	0.9241	0.8242	0.6717	0.5276	0.5946	0.8259	0.9609	0.9903	0.9957	(86)
MIT	18.9476	19.1885	19.6000	20.1379	20.5866	20.8601	20.9548	20.9318	20.6944	20.0863	19.4190	18.9115	(87)
Th 2	19.7655	19.7683	19.7711	19.7841	19.7865	19.7979	19.7979	19.8001	19.7935	19.7865	19.7816	19.7764	(88)
util rest of house	0.9930	0.9852	0.9639	0.9024	0.7734	0.5787	0.3990	0.4641	0.7544	0.9456	0.9872	0.9945	(89)
MIT 2	17.9094	18.1508	18.5594	19.0892	19.4994	19.7268	19.7840	19.7766	19.6100	19.0525	18.3913	17.8814	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	18.1199	18.3612	18.7704	19.3018	19.7198	19.9566	20.0214	20.0109	19.8298	19.2621	18.5997	18.0902	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1199	18.3612	18.7704	19.3018	19.7198	19.9566	20.0214	20.0109	19.8298	19.2621	18.5997	18.0902	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9802	0.9554	0.8917	0.7702	0.5921	0.4243	0.4889	0.7570	0.9367	0.9829	0.9922 (94)
Useful gains	521.3786	637.4024	758.7504	855.9964	831.8901	640.2810	436.2102	450.7915	601.2279	598.0937	518.2566	487.0873 (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	1879.9440	1826.3267	1660.4597	1390.4610	1069.5720	706.6985	451.3883	475.4221	759.1098	1155.2336	1540.8408	1870.2127 (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	1010.7727	798.9572	670.8717	384.8145	176.8353	0.0000	0.0000	0.0000	0.0000	414.5121	736.2606	1029.0454 (98)
Space heating												5222.0695 (98)
Space heating per m2												(98) / (4) = 53.6367 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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	1240.1479	976.2866	1000.6523	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8116	0.8720	0.8350	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.5013	851.2757	835.5173	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1367.4308	1302.8480	1180.7628	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	259.8692	335.9698	256.8626	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													852.7016 (104)
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	64.9673	83.9924	64.2157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													213.1754 (107)
Space cooling per m2													2.1896 (108)
Energy for space heating													53.6367 (99)
Energy for space cooling													2.1896 (108)
Total													55.8263 (109)
Dwelling Fabric Energy Efficiency (DFEE)													55.8 (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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1195 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3695 (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) =	0.3695 (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	0.4711	0.4618	0.4526	0.4064	0.3972	0.3510	0.3510	0.3417	0.3695	0.3972	0.4156	0.4341 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5682	0.5789	0.5864	0.5942 (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)			20.0900	1.3258	26.6345		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051		(28a)
EW Brick AAC015	147.0400	24.3500	122.6900	0.1800	22.0842		(29a)
Plane Ceiling	48.0900		48.0900	0.1300	6.2517		(30)
Bay	1.1800		1.1800	0.1300	0.1534		(30)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2149		(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)							12.3682 (36)
Total fabric heat loss						(33) + (36) =	78.5831 (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	50.6332	50.2762	49.9262	48.2824	47.9748	46.5431	46.5431	46.2779	47.0946	47.9748	48.5970	49.2475 (38)
Heat transfer coeff	129.2163	128.8592	128.5093	126.8654	126.5579	125.1262	125.1262	124.8610	125.6776	126.5579	127.1801	127.8305 (39)
Average = Sum(39)m / 12 =												126.8640 (39)
HLP	1.3272	1.3235	1.3199	1.3031	1.2999	1.2852	1.2852	1.2825	1.2909	1.2999	1.3063	1.3130 (40)
HLP (average)												1.3030 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy conte	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1552.1566 (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												

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	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.1967	29.9086	30.8630	26.9071	25.8180	22.2790	20.6448	23.6902	23.9731	27.9383	30.4969	33.1176 (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	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5569	20.0348	16.2934	12.3351	9.2207	7.7845	8.4114	10.9335	14.6749	18.6331	21.7476	23.1838	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	45.9632	44.5069	41.4825	37.3710	34.7016	30.9430	27.7483	31.8416	33.2960	37.5515	42.3568	44.5130	(72)
Total internal gains	384.2135	382.8499	369.4949	347.3972	323.9056	302.0681	288.3820	292.3825	304.1675	326.4092	352.0367	372.2718	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W	
North	6.3400	10.6334	0.6300	0.7000	0.7700	20.6031	(74)
East	5.6200	19.6403	0.6300	0.7000	0.7700	33.7330	(76)
South	1.2400	46.7521	0.6300	0.7000	0.7700	17.7172	(78)
Southwest	0.9700	36.7938	0.6300	0.7000	0.7700	10.9073	(79)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115	(80)
Northwest	0.9700	11.2829	0.6300	0.7000	0.7700	3.3448	(81)

Solar gains	116.0169	217.8883	345.9473	498.9796	615.9855	634.7428	602.4400	512.8558	399.2425	254.2882	142.7984	96.7246	(83)
Total gains	500.2304	600.7382	715.4421	846.3768	939.8912	936.8109	890.8220	805.2382	703.4101	580.6975	494.8351	468.9964	(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	52.3240	52.4690	52.6119	53.2936	53.4231	54.0344	54.0344	54.1491	53.7973	53.4231	53.1617	52.8912	
alpha	4.4883	4.4979	4.5075	4.5529	4.5615	4.6023	4.6023	4.6099	4.5865	4.5615	4.5441	4.5261	
util living area	0.9989	0.9973	0.9917	0.9690	0.8989	0.7517	0.5904	0.6626	0.8951	0.9865	0.9978	0.9992	(86)
MIT	19.4504	19.6203	19.9204	20.3291	20.6881	20.9091	20.9768	20.9616	20.7766	20.3020	19.8050	19.4271	(87)
Th 2	19.8196	19.8224	19.8252	19.8384	19.8409	19.8525	19.8525	19.8546	19.8480	19.8409	19.8359	19.8307	(88)
util rest of house	0.9985	0.9963	0.9885	0.9561	0.8557	0.6541	0.4500	0.5212	0.8318	0.9789	0.9968	0.9989	(89)
MIT 2	18.4124	18.5841	18.8847	19.2956	19.6287	19.8106	19.8467	19.8436	19.7188	19.2765	18.7793	18.3977	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	18.6229	18.7942	19.0947	19.5051	19.8435	20.0333	20.0759	20.0703	19.9333	19.4844	18.9873	18.6065	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6229	18.7942	19.0947	19.5051	19.8435	20.0333	20.0759	20.0703	19.9333	19.4844	18.9873	18.6065	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.2011	597.7936	705.2575	805.1847	804.3678	628.7255	426.5583	442.9398	589.1382	566.5552	492.7502	468.2800	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1850.7459	1790.3916	1618.5361	1345.4221	1030.6206	679.8470	434.9204	458.2782	733.1158	1124.3966	1511.8280	1841.5846	(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	1005.5493	801.4259	679.4793	388.9709	168.3321	0.0000	0.0000	0.0000	0.0000	415.0340	733.7360	1021.7386	(98)
Space heating												5214.2661	(98)
Space heating per m2												53.5566	(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	1176.1858	925.9335	948.9437	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8291	0.8959	0.8587	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	975.2319	829.5287	814.8736	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1198.5441	1142.5657	1044.3525	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	160.7848	232.8996	170.7323	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												564.4166 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.1962	58.2249	42.6831	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.1041 (107)
Space cooling per m2												1.4493 (108)
Energy for space heating												53.5566 (99)
Energy for space cooling												1.4493 (108)
Total												55.0059 (109)
Target Fabric Energy Efficiency (TFEE)												63.3 (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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
												133.7720 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
												1718 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				6.7100	11.9814	0.4600	0.0000		0.7700		28.4761 (74)	
East				2.6200	22.3313	0.4600	0.0000		0.7700		20.7236 (76)	
South				1.3100	50.9848	0.4600	0.0000		0.7700		23.6571 (78)	
Southwest				1.0300	40.4699	0.4600	0.0000		0.7700		14.7645 (79)	
West				5.2500	22.3313	0.4600	0.0000		0.7700		41.5262 (80)	
Northwest				1.0300	12.9236	0.4600	0.0000		0.7700		4.7149 (81)	
East				3.3300	22.3313	0.4600	0.0000		0.7700		26.3395 (76)	
Solar gains	160.2017	271.3658	426.7256	635.2180	764.0725	842.4108	790.9825	688.6756	534.2164	338.5120	202.1490	132.1810 (83)
Total gains	780.4385	886.9395	1018.4030	1189.6488	1280.1272	1324.1533	1252.6854	1159.1774	1026.1568	867.9243	773.2820	735.1116 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
alpha	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
util living area	0.9793	0.9675	0.9350	0.8510	0.7005	0.4762	0.3239	0.3576	0.6528	0.8912	0.9641	0.9825 (86)
MIT	19.3577	19.5604	19.9574	20.4399	20.7935	20.9621	20.9928	20.9900	20.8831	20.4342	19.8344	19.3333 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9740	0.9592	0.9180	0.8129	0.6278	0.3711	0.1999	0.2265	0.5488	0.8533	0.9532	0.9780 (89)
MIT 2	17.6417	17.9370	18.5013	19.1651	19.6004	19.7737	19.7891	19.7939	19.7144	19.1816	18.3455	17.6150 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	17.9896	18.2662	18.7965	19.4236	19.8423	20.0147	20.0332	20.0364	19.9513	19.4356	18.6474	17.9634 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8396	18.1162	18.6465	19.2736	19.6923	19.8647	19.8832	19.8864	19.8013	19.2856	18.4974	17.8134 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9617	0.9435	0.8976	0.7939	0.6219	0.3776	0.2096	0.2366	0.5495	0.8334	0.9367	0.9670 (94)
Useful gains	750.5289	836.8113	914.0898	944.4557	796.0759	499.9819	262.5060	274.2707	563.9154	723.3126	724.3572	710.8343 (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	1733.1815	1692.0350	1520.3917	1255.8599	896.6249	512.1197	263.4917	275.7635	609.7367	1023.9119	1398.5100	1708.3121 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	731.0935	574.7103	451.0886	224.2111	74.8084	0.0000	0.0000	0.0000	0.0000	223.6459	485.3900	742.1235 (98)
Space heating												3507.0713 (98)
RHI space heating demand												3507 (98)

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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283 (22b)
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	55.0546	54.5259	54.0076	51.5733	51.1179	48.9977	48.9977	48.6051	49.8144	51.1179	52.0393	53.0025 (38)
Average = Sum(39)m / 12 =	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
												136.9449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4424	1.4369	1.4316	1.4066	1.4019	1.3802	1.3802	1.3761	1.3885	1.4019	1.4114	1.4213 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (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
	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (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)												
	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)												
	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	10.6334	0.4600	0.0000	0.7700	25.2722 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	1.3100	46.7521	0.4600	0.0000	0.7700	21.6931 (78)
Southwest	1.0300	36.7938	0.4600	0.0000	0.7700	13.4233 (79)
West	5.2500	19.6403	0.4600	0.0000	0.7700	36.5221 (80)
Northwest	1.0300	11.2829	0.4600	0.0000	0.7700	4.1163 (81)
East	3.3300	19.6403	0.4600	0.0000	0.7700	23.1654 (76)

Solar gains	142.4186	267.4836	424.7112	612.6046	756.2628	779.2931	739.6336	629.6444	490.1480	312.1749	175.2969	118.7346 (83)
Total gains	762.6554	883.0572	1016.3886	1167.0355	1272.3175	1261.0356	1201.3365	1100.1462	982.0884	841.5872	746.4299	721.6652 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
alpha	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
util living area	0.9833	0.9721	0.9465	0.8838	0.7702	0.6097	0.4688	0.5233	0.7520	0.9221	0.9735	0.9860 (86)
MIT	19.1457	19.3777	19.7661	20.2670	20.6606	20.8926	20.9669	20.9521	20.7715	20.2453	19.6149	19.1161 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house	0.9792	0.9652	0.9329	0.8539	0.7123	0.5166	0.3487	0.3999	0.6692	0.8953	0.9656	0.9825 (89)
MIT 2	17.3131	17.6503	18.2082	18.9167	19.4284	19.7020	19.7644	19.7590	19.5833	18.9081	18.0094	17.2800 (90)
Living area fraction												0.2028 (91)
MIT	17.6847	18.0005	18.5240	19.1904	19.6782	19.9434	20.0082	20.0009	19.8242	19.1792	18.3349	17.6523 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5347	17.8505	18.3740	19.0404	19.5282	19.7934	19.8582	19.8509	19.6742	19.0292	18.1849	17.5023 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9682	0.9503	0.9129	0.8326	0.6998	0.5178	0.3569	0.4073	0.6616	0.8743	0.9512	0.9728 (94)
Useful gains	738.3987	839.1744	927.9003	971.7186	890.3642	653.0089	428.7705	448.1306	649.7125	735.7913	709.9774	702.0392 (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	1858.5203	1811.7730	1655.0180	1388.7027	1068.4882	697.8417	437.8122	462.3418	753.5720	1150.5157	1523.2082	1840.7217 (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	833.3704	653.5863	540.9755	300.2286	132.5242	0.0000	0.0000	0.0000	0.0000	308.5550	585.5262	847.1798 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 4201.9461 (98)
 Space heating per m2 (98) / (4) = 43.1589 (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												4643.0344	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	833.3704	653.5863	540.9755	300.2286	132.5242	0.0000	0.0000	0.0000	0.0000	308.5550	585.5262	847.1798	(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)	920.8513	722.1948	597.7630	331.7443	146.4356	0.0000	0.0000	0.0000	0.0000	340.9448	646.9903	936.1103	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater	89.9277	89.8734	89.7515	89.4561	88.8533	87.3000	87.3000	87.3000	87.3000	89.4491	89.8034	89.9490	(216)
Fuel for water heating, kWh/month	194.6765	170.8063	177.5379	156.7567	152.5250	135.5997	127.2799	143.7432	144.7757	162.7145	175.0178	188.9718	(219)
Water heating fuel used												1930.4050	(219)
Annual totals kWh/year													
Space heating fuel - main system												4643.0344	(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)												396.9635	(232)
Total delivered energy for all uses												7045.4029	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4643.0344	3.4800	161.5776	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1930.4050	3.4800	67.1781	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.9635	13.1900	52.3595	(250)
Additional standing charges			120.0000	(251)
Total energy cost			411.0077	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2126	(257)
SAP value		83.0845	
SAP rating (Section 12)		83	(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	4643.0344	0.2160	1002.8954	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1930.4050	0.2160	416.9675	(264)
Space and water heating			1419.8629	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total kg/year			1664.8120	(272)
CO2 emissions per m2			17.1000	(273)
EI value			84.3295	
EI rating			84	(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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8886 = 3.916$, stars = 4
 $0.216 / 0.8886 = 0.2431$, stars = 4

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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
Effective ac	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
	133.7720 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
								Total per year (kWh/year) =	Sum (64)m =			1717.7401 (64)

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
	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (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)												
	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)												
	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	11.9814	0.4600	0.0000	0.7700	28.4761 (74)
East	2.6200	22.3313	0.4600	0.0000	0.7700	20.7236 (76)
South	1.3100	50.9848	0.4600	0.0000	0.7700	23.6571 (78)
Southwest	1.0300	40.4699	0.4600	0.0000	0.7700	14.7645 (79)
West	5.2500	22.3313	0.4600	0.0000	0.7700	41.5262 (80)
Northwest	1.0300	12.9236	0.4600	0.0000	0.7700	4.7149 (81)
East	3.3300	22.3313	0.4600	0.0000	0.7700	26.3395 (76)

Solar gains	160.2017	271.3658	426.7256	635.2180	764.0725	842.4108	790.9825	688.6756	534.2164	338.5120	202.1490	132.1810 (83)
Total gains	780.4385	886.9395	1018.4030	1189.6488	1280.1272	1324.1533	1252.6854	1159.1774	1026.1568	867.9243	773.2820	735.1116 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
util living area	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
	0.9793	0.9675	0.9350	0.8510	0.7005	0.4762	0.3239	0.3576	0.6528	0.8912	0.9641	0.9825 (86)
MIT	19.3577	19.5604	19.9574	20.4399	20.7935	20.9621	20.9928	20.9900	20.8831	20.4342	19.8344	19.3333 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9740	0.9592	0.9180	0.8129	0.6278	0.3711	0.1999	0.2265	0.5488	0.8533	0.9532	0.9780 (89)
MIT 2	17.6417	17.9370	18.5013	19.1651	19.6004	19.7737	19.7891	19.7939	19.7144	19.1816	18.3455	17.6150 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	17.9896	18.2662	18.7965	19.4236	19.8423	20.0147	20.0332	20.0364	19.9513	19.4356	18.6474	17.9634 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8396	18.1162	18.6465	19.2736	19.6923	19.8647	19.8832	19.8864	19.8013	19.2856	18.4974	17.8134 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9617	0.9435	0.8976	0.7939	0.6219	0.3776	0.2096	0.2366	0.5495	0.8334	0.9367	0.9670 (94)
Ext temp.	750.5289	836.8113	914.0898	944.4557	796.0759	499.9819	262.5060	274.2707	563.9154	723.3126	724.3572	710.8343 (95)
Heat loss rate W	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)
Month fracti	1733.1815	1692.0350	1520.3917	1255.8599	896.6249	512.1197	263.4917	275.7635	609.7367	1023.9119	1398.5100	1708.3121 (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)
	731.0935	574.7103	451.0886	224.2111	74.8084	0.0000	0.0000	0.0000	0.0000	223.6459	485.3900	742.1235 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 3507.0713 (98)
 Space heating per m2 (98) / (4) = 36.0217 (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													3875.2169 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	731.0935	574.7103	451.0886	224.2111	74.8084	0.0000	0.0000	0.0000	0.0000	223.6459	485.3900	742.1235	(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)	807.8381	635.0390	498.4405	247.7470	82.6612	0.0000	0.0000	0.0000	0.0000	247.1225	536.3426	820.0259	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater	89.8636	89.8061	89.6423	89.2413	88.4119	87.3000	87.3000	87.3000	87.3000	89.2109	89.6958	89.8860	(216)
(217)m	89.8636	89.8061	89.6423	89.2413	88.4119	87.3000	87.3000	87.3000	87.3000	89.2109	89.6958	89.8860	(217)
Fuel for water heating, kWh/month	194.8155	170.9344	177.7541	157.1339	153.2866	135.5997	127.2799	143.7432	144.7757	163.1490	175.2278	189.1043	(219)
Water heating fuel used												1932.8040	(219)
Annual totals kWh/year													
Space heating fuel - main system												3875.2169	(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)												396.9635	(232)
Total delivered energy for all uses												6279.9844	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3875.2169	9.7400	377.4461	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1932.8040	9.7400	188.2551	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	396.9635	36.8500	146.2811	(250)
Additional standing charges			104.0000	(251)
Total energy cost			843.6198	(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	3875.2169	0.2160	837.0469	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1932.8040	0.2160	417.4857	(264)
Space and water heating			1254.5325	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total kg/year			1499.4816	(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	3875.2169	1.2200	4727.7646	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1932.8040	1.2200	2358.0208	(264)
Space and water heating			7085.7855	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.9635	3.0700	1218.6781	(268)
Primary energy kWh/year			8534.7135	(272)
Primary energy kWh/m2/year			87.6614	(273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 83
Current environmental impact rating: B 84

(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	-£ 78	-189 kg (12.6%)
U Solar photovoltaic panels	+ 9.4	-£ 672	-947 kg (72.2%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£78	1.94 kg/m²	B 84	B 86
Solar photovoltaic panels	£672	9.72 kg/m²	A 94	A 95
Total Savings	£751	11.66 kg/m²		

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	£174	£192	-£18
Mains gas	£670	£573	£97
Space heating	£509	£509	£0
Water heating	£188	£110	£78
Lighting	£146	£146	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£844	£93	£751
Total cost of uses	£843	£93	£750
Delivered energy	65 kWh/m²	36 kWh/m²	28 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	4 kg/m²	12 kg/m²
Primary energy	88 kWh/m²	19 kWh/m²	68 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283 (22b)
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	55.0546	54.5259	54.0076	51.5733	51.1179	48.9977	48.9977	48.6051	49.8144	51.1179	52.0393	53.0025 (38)
Average = Sum(39)m / 12 =	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
												136.9449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4424	1.4369	1.4316	1.4066	1.4019	1.3802	1.3802	1.3761	1.3885	1.4019	1.4114	1.4213 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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												1.1684 (H8)
Utilisation factor												0.5751 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6505 (H14)
Volume ratio Veff/V												0.7603 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-866.7922 (H17)
Solar input	-25.1352	-41.9435	-71.4346	-95.7364	-118.2743	-116.2825	-114.7457	-100.2539	-78.5189	-53.6192	-29.8140	-21.0339 (63)
								Solar input (sum of months) =	Sum (63)m =			-866.7922 (63)
Output from w/h	149.9330	111.5660	87.9082	44.4919	17.2493	2.0961	0.0000	25.2339	47.8702	91.9274	127.3579	148.9444 (64)
								Total per year (kWh/year) =	Sum (64)m =			854.5783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (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	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	10.6334	0.4600	0.0000	0.7700	25.2722 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	1.3100	46.7521	0.4600	0.0000	0.7700	21.6931 (78)
Southwest	1.0300	36.7938	0.4600	0.0000	0.7700	13.4233 (79)
West	5.2500	19.6403	0.4600	0.0000	0.7700	36.5221 (80)
Northwest	1.0300	11.2829	0.4600	0.0000	0.7700	4.1163 (81)
East	3.3300	19.6403	0.4600	0.0000	0.7700	23.1654 (76)

Solar gains	142.4186	267.4836	424.7112	612.6046	756.2628	779.2931	739.6336	629.6444	490.1480	312.1749	175.2969	118.7346 (83)
Total gains	762.6554	883.0572	1016.3886	1167.0355	1272.3175	1261.0356	1201.3365	1100.1462	982.0884	841.5872	746.4299	721.6652 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
alpha	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
util living area	0.9833	0.9721	0.9465	0.8838	0.7702	0.6097	0.4688	0.5233	0.7520	0.9221	0.9735	0.9860 (86)
MIT	19.1457	19.3777	19.7661	20.2670	20.6606	20.8926	20.9669	20.9521	20.7715	20.2453	19.6149	19.1161 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house												
	0.9792	0.9652	0.9329	0.8539	0.7123	0.5166	0.3487	0.3999	0.6692	0.8953	0.9656	0.9825 (89)
MIT 2	17.3131	17.6503	18.2082	18.9167	19.4284	19.7020	19.7644	19.7590	19.5833	18.9081	18.0094	17.2800 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)

AES
Sustainability
Consultants

MIT	17.6847	18.0005	18.5240	19.1904	19.6782	19.9434	20.0082	20.0009	19.8242	19.1792	18.3349	17.6523 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5347	17.8505	18.3740	19.0404	19.5282	19.7934	19.8582	19.8509	19.6742	19.0292	18.1849	17.5023 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4643.0344	0.2160	1002.8954 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	952.4050	0.2160	205.7195 (264)
Space and water heating			1208.6149 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.9635	0.5190	206.0241 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			583.0768 (272)
CO2 emissions per m2			5.9900 (273)
EI value			94.5116
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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
Effective ac	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
	133.7720 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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 conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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												1.2340 (H8)
Utilisation factor												0.5553 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6505 (H14)
Volume ratio Veff/V												0.7603 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input	-27.2079	-40.8934	-68.8697	-95.1991	-114.6517	-120.6659	-117.7685	-105.1680	-82.0840	-55.8402	-33.0719	-883.9623 (H17)
Solar input (sum of months) = Sum (63)m =												-22.5419 (63)
Output from w/h	147.8603	112.6160	90.4731	45.0293	20.8719	0.0000	0.0000	20.3198	44.3052	89.7064	124.1000	147.4364 (64)
Total per year (kWh/year) = Sum (64)m =												842.7184 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (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	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (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)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	11.9814	0.4600	0.0000	0.7700	28.4761 (74)
East	2.6200	22.3313	0.4600	0.0000	0.7700	20.7236 (76)
South	1.3100	50.9848	0.4600	0.0000	0.7700	23.6571 (78)
Southwest	1.0300	40.4699	0.4600	0.0000	0.7700	14.7645 (79)
West	5.2500	22.3313	0.4600	0.0000	0.7700	41.5262 (80)
Northwest	1.0300	12.9236	0.4600	0.0000	0.7700	4.7149 (81)
East	3.3300	22.3313	0.4600	0.0000	0.7700	26.3395 (76)

Solar gains	160.2017	271.3658	426.7256	635.2180	764.0725	842.4108	790.9825	688.6756	534.2164	338.5120	202.1490	132.1810 (83)
Total gains	780.4385	886.9395	1018.4030	1189.6488	1280.1272	1324.1533	1252.6854	1159.1774	1026.1568	867.9243	773.2820	735.1116 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
alpha	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
util living area	0.9793	0.9675	0.9350	0.8510	0.7005	0.4762	0.3239	0.3576	0.6528	0.8912	0.9641	0.9825 (86)
MIT	19.3577	19.5604	19.9574	20.4399	20.7935	20.9621	20.9928	20.9900	20.8831	20.4342	19.8344	19.3333 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9740	0.9592	0.9180	0.8129	0.6278	0.3711	0.1999	0.2265	0.5488	0.8533	0.9532	0.9780 (89)
MIT 2	17.6417	17.9370	18.5013	19.1651	19.6004	19.7737	19.7891	19.7939	19.7144	19.1816	18.3455	17.6150 (90)
Living area fraction												fLA = Living area / (4) = 0.2028 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT	17.9896	18.2662	18.7965	19.4236	19.8423	20.0147	20.0332	20.0364	19.9513	19.4356	18.6474	17.9634 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8396	18.1162	18.6465	19.2736	19.6923	19.8647	19.8832	19.8864	19.8013	19.2856	18.4974	17.8134 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9617	0.9435	0.8976	0.7939	0.6219	0.3776	0.2096	0.2366	0.5495	0.8334	0.9367	0.9670 (94)	
Useful gains	750.5289	836.8113	914.0898	944.4557	796.0759	499.9819	262.5060	274.2707	563.9154	723.3126	724.3572	710.8343 (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	1733.1815	1692.0350	1520.3917	1255.8599	896.6249	512.1197	263.4917	275.7635	609.7367	1023.9119	1398.5100	1708.3121 (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	731.0935	574.7103	451.0886	224.2111	74.8084	0.0000	0.0000	0.0000	0.0000	223.6459	485.3900	742.1235 (98)	
Space heating												3507.0713 (98)	
Space heating per m2										(98) / (4) =		36.0217 (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													3875.2169 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	731.0935	574.7103	451.0886	224.2111	74.8084	0.0000	0.0000	0.0000	0.0000	223.6459	485.3900	742.1235 (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)	807.8381	635.0390	498.4405	247.7470	82.6612	0.0000	0.0000	0.0000	0.0000	247.1225	536.3426	820.0259 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	147.8603	112.6160	90.4731	45.0293	20.8719	0.0000	0.0000	20.3198	44.3052	89.7064	124.1000	147.4364 (64)	
Efficiency of water heater (217)m	89.9454	89.9597	89.9492	89.9486	89.7821	87.3000	87.3000	87.3000	87.3000	89.5602	89.8296	89.9535 (217)	
Fuel for water heating, kWh/month	164.3890	125.1850	100.5824	50.0611	23.2472	0.0000	0.0000	23.2759	50.7505	100.1633	138.1505	163.9028 (219)	
Water heating fuel used												939.7078 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3875.2169 (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)													396.9635 (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													3512.7286 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3875.2169	9.7400	377.4461 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	939.7078	9.7400	91.5275 (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	396.9635	36.8500	146.2811 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028 (252)	
Total energy cost			93.1144 (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	3875.2169	0.2160	837.0469 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	939.7078	0.2160	202.9769 (264)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			1040.0237 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.9635	0.5190	206.0241 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			364.1840 (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	3875.2169	1.2200	4727.7646 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.7078	1.2200	1146.4435 (264)
Space and water heating			5874.2081 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	396.9635	3.0700	1218.6781 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1876.4661 (272)
Primary energy kWh/m2/year			19.2735 (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
Overshading	Average or unknown
Thermal mass parameter	179.3 (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	331.51 (P1)
Transmission heat loss coefficient	85.37 (37)
Summer heat loss coefficient	416.88 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.7100	81.1852	0.4600	0.0000	0.9000	225.5275
East	2.6200	117.5071	0.4600	0.0000	0.9000	127.4576
South	1.3100	112.2060	0.4600	0.0000	0.9000	60.8538
South West	1.0300	119.9223	0.4600	0.0000	0.9000	51.1373
West	5.2500	117.5071	0.4600	0.0000	0.9000	255.4016
North West	1.0300	98.8453	0.4600	0.0000	0.9000	42.1496
East	3.3300	117.5071	0.4600	0.0000	0.9000	161.9976
total:						924.5250

Solar gains	Jun 985	Jul 925	Aug 805	(P4)
Internal gains	479	459	468	
Total summer gains	1463	1383	1272	(P5)
Summer gain/loss ratio	3.51	3.32	3.05	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 179.3)	0.74	0.74	0.74	
Threshold temperature	20.25	21.96	21.60	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Assessment of likelihood of high internal temperature:

Slight