

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-627				Issued on Date	22/03/2023
Assessment Reference	Plot 627	Prop Type Ref	Dawlish-OP-DET			
Property	Plot 627, 3 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.90	TER	18.71	
Environmental	85 B	% DER<TER	4.31			
CO ₂ Emissions (t/year)	1.44	DFEE	52.59	TFEE	59.65	
General Requirements Compliance	Pass	% DFEE<TFEE	11.85			
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

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

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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) 18.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (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 ESPl 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): Medium OK

Based on:

Overshading: Average
Windows facing North: 1.31 m², No overhang
Windows facing East: 5.95 m², No overhang
Windows facing South: 6.71 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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 (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												

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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	1.3100	10.6334	0.4600	0.0000	0.7700	4.9339 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	6.7100	46.7521	0.4600	0.0000	0.7700	111.1148 (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	211.5021	375.0659	545.2169	717.3620	833.0672	837.7492	803.3934	716.9548	605.6146	423.8680	256.2022	179.0482 (83)
Total gains	629.3444	790.7270	945.8197	1093.5440	1184.2500	1164.9638	1115.1076	1034.9859	936.2465	779.1460	639.8238	584.1235 (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
	0.9905	0.9795	0.9556	0.8995	0.7971	0.6450	0.4997	0.5498	0.7709	0.9355	0.9829	0.9925 (86)
MIT	18.9985	19.2800	19.6982	20.2110	20.6184	20.8721	20.9598	20.9442	20.7517	20.1900	19.5005	18.9622 (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	0.9880	0.9742	0.9439	0.8724	0.7420	0.6510	0.3739	0.4227	0.6900	0.9123	0.9776	0.9906 (89)
MIT 2	17.1003	17.5106	18.1136	18.8437	19.3811	19.6854	19.7610	19.7548	19.5641	18.8348	17.8460	17.0570 (90)
Living area fraction	17.4852	17.8693	18.4349	19.1209	19.6320	19.9260	20.0041	19.9959	19.8049	19.1096	18.1815	17.4433 (91)
MIT	17.4852	17.8693	18.4349	19.1209	19.6320	19.9260	20.0041	19.9959	19.8049	19.1096	18.1815	17.4433 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3352	17.7193	18.2849	18.9709	19.4820	19.7760	19.8541	19.8459	19.6549	18.9596	18.0315	17.2933 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9805	0.9617	0.9252	0.8509	0.7275	0.5507	0.3821	0.4299	0.6810	0.8919	0.9664	0.9844 (94)
Ext temp.	617.0715	760.4773	875.1088	930.4470	861.5657	641.5874	426.1230	444.9487	637.5681	694.8847	618.3020	574.9969 (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	1830.5061	1793.4180	1642.5892	1379.1825	1062.1751	695.5023	437.2566	461.6803	750.9550	1141.0143	1502.1233	1811.7950 (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)
	902.7954	694.1361	571.0054	323.0895	149.2534	0.0000	0.0000	0.0000	0.0000	331.9204	636.3513	920.1778 (98)

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Space heating
Space heating per m2 (98) / (4) = 4528.7294 (98)
46.5153 (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													5004.1208 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	902.7954	694.1361	571.0054	323.0895	149.2534	0.0000	0.0000	0.0000	0.0000	331.9204	636.3513	920.1778	(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)	997.5640	767.0012	630.9452	357.0050	164.9209	0.0000	0.0000	0.0000	0.0000	366.7628	703.1507	1016.7710	(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	89.9644	89.9032	89.7820	89.5070	88.9484	87.3000	87.3000	87.3000	87.3000	89.5000	89.8477	89.9857	(216)
(217)m	89.9644	89.9032	89.7820	89.5070	88.9484	87.3000	87.3000	87.3000	87.3000	89.5000	89.8477	89.9857	(217)
Fuel for water heating, kWh/month	194.5972	170.7498	177.4775	156.6675	152.3620	135.5997	127.2799	143.7432	144.7757	162.6220	174.9316	188.8948	(219)
Water heating fuel used												1929.7007	(219)
Annual totals kWh/year													
Space heating fuel - main system												5004.1208	(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												7405.7851	(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	5004.1208	0.2160	1080.8901	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.7007	0.2160	416.8154	(264)
Space and water heating			1497.7055	(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			1742.6545	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9000	(273)

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

DER		17.9000	ZC1
Total Floor Area	TFA	97.3600	
Assumed number of occupants	N	2.7137	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3372	ZC2
CO2 emissions from cooking, equation (L16)		1.8912	ZC3
Total CO2 emissions		35.1284	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		35.1284	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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 = C _m / 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												

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Calculation Type: New Build (As Designed)

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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 (61)
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				1.2400	10.6334	0.6300	0.7000		0.7700		4.0296 (74)	
East				5.6200	19.6403	0.6300	0.7000		0.7700		33.7330 (76)	
South				6.3400	46.7521	0.6300	0.7000		0.7700		90.5862 (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	172.3124	305.5562	444.1463	584.3455	678.5727	682.3781	654.3974	584.0042	493.3353	345.3060	208.7275	145.8737 (83)
Total gains	602.6049	733.6627	857.1899	972.4006	1040.9533	1020.1229	976.6520	913.2465	835.8596	713.0441	604.8065	563.4055 (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	0.9976	0.9940	0.9835	0.9502	0.8666	0.7104	0.5454	0.5992	0.8358	0.9711	0.9950	0.9983	(86)
MIT	19.5453	19.7420	20.0453	20.4265	20.7419	20.9283	20.9832	20.9744	20.8414	20.4143	19.9063	19.5150	(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	0.9968	0.9918	0.9774	0.9312	0.8159	0.6111	0.4123	0.4644	0.7564	0.9564	0.9928	0.9977	(89)
MIT 2	17.8970	18.1855	18.6267	19.1756	19.5921	19.8059	19.8466	19.8446	19.7239	19.1704	18.4357	17.8604	(90)
Living area fraction	18.2312	18.5011	18.9143	19.4292	19.8252	20.0334	20.0770	20.0736	19.9505	19.4226	18.7339	18.1958	(91)
MIT	18.2312	18.5011	18.9143	19.4292	19.8252	20.0334	20.0770	20.0736	19.9505	19.4226	18.7339	18.1958	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2312	18.5011	18.9143	19.4292	19.8252	20.0334	20.0770	20.0736	19.9505	19.4226	18.7339	18.1958	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9951	0.9883	0.9709	0.9226	0.8151	0.6282	0.4394	0.4916	0.7647	0.9491	0.9898	0.9963	(94)
Ext temp.	599.6474	725.1019	832.2568	897.1735	848.5288	640.8081	429.1657	448.9430	639.1859	676.7293	598.6275	561.3350	(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	1800.1414	1752.6285	1595.3565	1335.7947	1028.3096	679.8665	435.0669	458.6945	735.2726	1116.5645	1479.5969	1789.0963	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	893.1676	690.4978	567.7462	315.8073	133.7569	0.0000	0.0000	0.0000	0.0000	327.2374	634.2980	913.4544	(98)
Space heating per m2												4475.9656	(98)
												45.9734	(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													4792.2544	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	893.1676	690.4978	567.7462	315.8073	133.7569	0.0000	0.0000	0.0000	0.0000	327.2374	634.2980	913.4544	(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)	956.2822	739.2911	607.8653	338.1234	143.2087	0.0000	0.0000	0.0000	0.0000	350.3612	679.1199	978.0026	(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	88.2712	88.0423	87.5712	86.5294	84.4730	80.3000	80.3000	80.3000	80.3000	86.5054	87.8247	88.3486	(216)	
Fuel for water heating, kWh/month	240.0380	212.1409	224.0423	201.4324	199.7697	185.0896	177.3299	197.6813	199.8645	210.8925	219.5621	234.0802	(219)	
Water heating fuel used												2501.9234	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4792.2544	(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												7767.5387	(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	4792.2544	0.2160	1035.1269 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2501.9234	0.2160	540.4154 (264)
Space and water heating			1575.5424 (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			1821.2168 (272)
Emissions per m2 for space and water heating			16.1826 (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) = (16.1826 * 1.00) + 2.1236 + 0.3998, rounded to 2 d.p.			18.7100 (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				1.3100	10.6334		0.4600		0.0000		0.7700		4.9339 (74)
East				2.6200	19.6403		0.4600		0.0000		0.7700		18.2262 (76)
South				6.7100	46.7521		0.4600		0.0000		0.7700		111.1148 (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	211.5021	375.0659	545.2169	717.3620	833.0672	837.7492	803.3934	716.9548	605.6146	423.8680	256.2022	179.0482	(83)
Total gains	595.6364	757.8455	914.6546	1064.7159	1156.9405	1139.7900	1091.7459	1009.2989	909.7307	750.2119	608.1626	551.2386	(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	0.9919	0.9816	0.9584	0.9029	0.8001	0.6483	0.5018	0.5543	0.7767	0.9401	0.9851	0.9938 (86)
MIT	19.0265	19.3075	19.7234	20.2255	20.6284	20.8750	20.9612	20.9452	20.7543	20.1947	19.5098	18.9811 (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	0.9898	0.9769	0.9474	0.8768	0.7461	0.5553	0.3774	0.4283	0.6975	0.9184	0.9805	0.9922 (89)
MIT 2	17.9877	18.2679	18.6782	19.1686	19.5322	19.7353	19.7862	19.7818	19.6518	19.1532	18.4807	17.9505 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	18.1983	18.4787	18.8901	19.3829	19.7545	19.9664	20.0245	20.0177	19.8753	19.3644	18.6894	18.1594 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1983	18.4787	18.8901	19.3829	19.7545	19.9664	20.0245	20.0177	19.8753	19.3644	18.6894	18.1594 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9861	0.9702	0.9374	0.8664	0.7445	0.5695	0.4020	0.4527	0.7037	0.9087	0.9748	0.9891 (94)
Useful gains	587.3302	735.2949	857.3526	922.4849	861.2936	649.0548	438.9325	456.8598	640.1518	681.7335	592.8314	545.2063 (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	1890.6150	1842.2767	1676.6707	1401.2987	1074.1940	707.9948	451.7930	476.3183	765.1379	1168.8706	1552.8592	1879.5294 (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	969.6439	743.8918	609.5727	344.7460	158.3979	0.0000	0.0000	0.0000	0.0000	362.4300	691.2200	992.7364 (98)
Space heating												4872.6385 (98)
Space heating per m2												(98) / (4) = 50.0476 (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	0.8284	0.8867	0.8607	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1027.3384	865.7048	861.3041	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1435.7561	1377.3725	1282.8139	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	294.0607	380.6807	313.6033	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			988.3447	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	73.5152	95.1702	78.4008	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												247.0862	(107)
Energy for space heating												2.5379	(108)
Energy for space cooling												50.0476	(99)
Total												2.5379	(108)
												52.5855	(109)
Dwelling Fabric Energy Efficiency (DFEE)												52.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.2400	10.6334	0.6300	0.7000		0.7700		4.0296 (74)	
East				5.6200	19.6403	0.6300	0.7000		0.7700		33.7330 (76)	
South				6.3400	46.7521	0.6300	0.7000		0.7700		90.5862 (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	172.3124	305.5562	444.1463	584.3455	678.5727	682.3781	654.3974	584.0042	493.3353	345.3060	208.7275	145.8737 (83)
Total gains	556.5259	688.4061	813.6412	931.7426	1002.4784	984.4462	942.7793	876.3867	797.5028	671.7153	560.7641	518.1454 (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	0.9983	0.9953	0.9864	0.9568	0.8792	0.7279	0.5625	0.6199	0.8536	0.9767	0.9963	0.9988	(86)
MIT	19.5027	19.7008	20.0074	20.3960	20.7224	20.9207	20.9809	20.9707	20.8246	20.3801	19.8659	19.4729	(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	0.9977	0.9937	0.9814	0.9398	0.8312	0.6290	0.4265	0.4825	0.7782	0.9644	0.9947	0.9984	(89)
MIT 2	18.4645	18.6640	18.9701	19.3579	19.6559	19.8167	19.8479	19.8466	19.7523	19.3511	18.8399	18.4435	(90)
Living area fraction										fLA = Living area / (4) =		0.2028	(91)
MIT	18.6750	18.8742	19.1804	19.5684	19.8722	20.0405	20.0776	20.0745	19.9697	19.5597	19.0479	18.6522	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6750	18.8742	19.1804	19.5684	19.8722	20.0405	20.0776	20.0745	19.9697	19.5597	19.0479	18.6522	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9969	0.9918	0.9776	0.9349	0.8327	0.6468	0.4544	0.5105	0.7876	0.9604	0.9932	0.9977	(94)
Ext temp.	554.7798	682.7502	795.4451	871.0681	834.8124	636.7252	428.3739	447.4354	628.0984	645.1429	556.9339	516.9625	(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	1857.4819	1800.7082	1629.5519	1353.4520	1034.2524	680.7536	435.1370	458.8017	737.6878	1133.9218	1519.5361	1847.4312	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	969.2104	751.2677	620.5755	347.3164	148.3834	0.0000	0.0000	0.0000	0.0000	363.6515	693.0736	989.8687	(98)
Space heating per m2										(98) / (4) =		50.1576	(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	0.8468	0.9103	0.8846	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	996.0311	842.8931	839.4420	0.0000	0.0000	0.0000	0.0000	(102)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1254.2218	1203.2950	1127.5130	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	185.8973	268.1390	214.3249	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												668.3612 (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	46.4743	67.0348	53.5812	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												167.0903 (107)
Space cooling per m2												1.7162 (108)
Energy for space heating												50.1576 (99)
Energy for space cooling												1.7162 (108)
Total												51.8738 (109)
Target Fabric Energy Efficiency (TFEE)												59.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 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				1.3100	11.9814	0.4600	0.0000		0.7700	5.5594 (74)		
East				2.6200	22.3313	0.4600	0.0000		0.7700	20.7236 (76)		
South				6.7100	50.9848	0.4600	0.0000		0.7700	121.1747 (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	234.8027	374.9359	539.3593	733.5737	832.2974	896.8812	850.3154	774.1656	650.1218	452.6556	291.4332	196.8312 (83)
Total gains	855.0395	990.5096	1131.0367	1288.0046	1348.3521	1378.6237	1312.0184	1244.6674	1142.0622	982.0680	862.5662	799.7619 (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	0.9732	0.9561	0.9160	0.8255	0.6780	0.4597	0.3099	0.3343	0.6049	0.8577	0.9518	0.9777 (86)
MIT	19.4374	19.6651	20.0560	20.5000	20.8140	20.9659	20.9937	20.9919	20.9080	20.5155	19.9236	19.4036 (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	0.9665	0.9455	0.8953	0.7839	0.6046	0.3573	0.1909	0.2112	0.5025	0.8129	0.9378	0.9720 (89)
MIT 2	17.7556	18.0847	18.6352	19.2388	19.6204	19.7759	19.7893	19.7943	19.7331	19.2815	18.4698	17.7159 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	18.0966	18.4051	18.9232	19.4945	19.8624	20.0172	20.0335	20.0371	19.9713	19.5317	18.7645	18.0581 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9466	18.2551	18.7732	19.3445	19.7124	19.8672	19.8835	19.8871	19.8213	19.3817	18.6145	17.9081 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9522	0.9275	0.8740	0.7665	0.6000	0.3639	0.2002	0.2207	0.5051	0.7946	0.9193	0.9593 (94)
Useful gains	814.1906	918.6622	988.4899	987.2775	809.0477	501.6220	262.6857	274.6655	576.8692	780.3579	792.9470	767.1869 (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	1747.7351	1710.8202	1537.5279	1265.3674	899.3175	512.4523	263.5372	275.8599	612.3815	1036.7190	1414.1209	1721.0379 (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												

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Space heating	694.5571	532.3302	408.4843	200.2247	67.1607	0.0000	0.0000	0.0000	0.0000	190.7327	447.2451	709.6651 (98)
RHI space heating demand												3250.3999 (98)
												3250 (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	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 (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	1.3100	10.6334	0.4600	0.0000	0.7700	4.9339 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	6.7100	46.7521	0.4600	0.0000	0.7700	111.1148 (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	211.5021	375.0659	545.2169	717.3620	833.0672	837.7492	803.3934	716.9548	605.6146	423.8680	256.2022	179.0482 (83)
Total gains	831.7389	990.6395	1136.8943	1271.7929	1349.1218	1319.4917	1265.0963	1187.4566	1097.5551	953.2804	827.3352	781.9788 (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
	0.9787	0.9620	0.9293	0.8605	0.7471	0.5895	0.4480	0.4908	0.7059	0.8958	0.9648	0.9823 (86)
MIT	19.2202	19.4877	19.8762	20.3407	20.6933	20.9032	20.9712	20.9605	20.8142	20.3367	19.6987	19.1822 (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	0.9735	0.9529	0.9123	0.8269	0.6872	0.4974	0.3320	0.3726	0.6200	0.8628	0.9548	0.9780 (89)
MIT 2	17.4202	17.8065	18.3601	19.0111	19.4643	19.7103	19.7664	19.7634	19.6234	19.0267	18.1279	17.3754 (90)
Living area fraction	17.7852	18.1474	18.6675	19.2807	19.7135	19.9522	20.0107	20.0061	19.8648	19.2923	18.4464	17.7417 (91)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	17.6352	17.9974	18.5175	19.1307	19.5635	19.8022	19.8607	19.8561	19.7148	19.1423	18.2964	17.5917 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9607	0.9355	0.8908	0.8065	0.6764	0.4993	0.3402	0.3802	0.6155	0.8418	0.9381	0.9667 (94)
Ext temp.	799.0580	926.7513	1012.7270	1025.6967	912.5962	658.8290	430.3363	451.5171	675.4954	802.5090	776.1279	755.9624 (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	1872.6347	1832.3187	1675.0105	1401.0657	1073.3044	699.0246	438.1409	463.0449	759.0549	1165.9490	1538.5266	1853.0949 (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)
	798.7411	608.5413	492.7390	270.2656	119.5668	0.0000	0.0000	0.0000	0.0000	270.3994	548.9271	816.2666 (98)

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Space heating 3925.4469 (98)
 Space heating per m2 (98) / (4) = 40.3189 (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												4337.5104	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	798.7411	608.5413	492.7390	270.2656	119.5668	0.0000	0.0000	0.0000	0.0000	270.3994	548.9271	816.2666	(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)	882.5868	672.4213	544.4629	298.6361	132.1181	0.0000	0.0000	0.0000	0.0000	298.7839	606.5493	901.9520	(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	89.9075	89.8367	89.6966	89.3808	88.7713	87.3000	87.3000	87.3000	87.3000	89.3539	89.7676	89.9319	(216)
Fuel for water heating, kWh/month	194.7203	170.8762	177.6465	156.8887	152.6660	135.5997	127.2799	143.7432	144.7757	162.8878	175.0877	189.0079	(217)
Water heating fuel used												1931.1795	(219)
Annual totals kWh/year													
Space heating fuel - main system												4337.5104	(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												6740.6534	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4337.5104	3.4800	150.9454	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1931.1795	3.4800	67.2050	(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			400.4024	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1813 (257)
SAP value	83.5209	
SAP rating (Section 12)	84	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4337.5104	0.2160	936.9022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1931.1795	0.2160	417.1348	(264)
Space and water heating			1354.0370	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total kg/year			1598.9861	(272)
CO2 emissions per m2			16.4200	(273)
EI value			84.9491	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

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

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Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8882 = 3.918$, stars = 4
 $0.216 / 0.8882 = 0.2432$, 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	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 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	1.3100	11.9814	0.4600	0.0000	0.7700	5.5594 (74)
East	2.6200	22.3313	0.4600	0.0000	0.7700	20.7236 (76)
South	6.7100	50.9848	0.4600	0.0000	0.7700	121.1747 (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	234.8027	374.9359	539.3593	733.5737	832.2974	896.8812	850.3154	774.1656	650.1218	452.6556	291.4332	196.8312 (83)
Total gains	855.0395	990.5096	1131.0367	1288.0046	1348.3521	1378.6237	1312.0184	1244.6674	1142.0622	982.0680	862.5662	799.7619 (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
	0.9732	0.9561	0.9160	0.8255	0.6780	0.4597	0.3099	0.3343	0.6049	0.8577	0.9518	0.9777 (86)
MIT	19.4374	19.6651	20.0560	20.5000	20.8140	20.9659	20.9937	20.9919	20.9080	20.5155	19.9236	19.4036 (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	0.9665	0.9455	0.8953	0.7839	0.6046	0.3573	0.1909	0.2112	0.5025	0.8129	0.9378	0.9720 (89)
MIT 2	17.7556	18.0847	18.6352	19.2388	19.6204	19.7759	19.7893	19.7943	19.7331	19.2815	18.4698	17.7159 (90)
Living area fraction	18.0966	18.4051	18.9232	19.4945	19.8624	20.0172	20.0335	20.0371	19.9713	19.5317	18.7645	18.0581 (91)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	17.9466	18.2551	18.7732	19.3445	19.7124	19.8672	19.8835	19.8871	19.8213	19.3817	18.6145	17.9081 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9522	0.9275	0.8740	0.7665	0.6000	0.3639	0.2002	0.2207	0.5051	0.7946	0.9193	0.9593 (94)
Ext temp.	814.1906	918.6622	988.4899	987.2775	809.0477	501.6220	262.6857	274.6655	576.8692	780.3579	792.9470	767.1869 (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	1747.7351	1710.8202	1537.5279	1265.3674	899.3175	512.4523	263.5372	275.8599	612.3815	1036.7190	1414.1209	1721.0379 (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)
	694.5571	532.3302	408.4843	200.2247	67.1607	0.0000	0.0000	0.0000	0.0000	190.7327	447.2451	709.6651 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating
Space heating per m2 (98) / (4) = 3250.3999 (98)
33.3854 (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													3591.6021 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	694.5571	532.3302	408.4843	200.2247	67.1607	0.0000	0.0000	0.0000	0.0000	190.7327	447.2451	709.6651	(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)	767.4664	588.2101	451.3638	221.2428	74.2107	0.0000	0.0000	0.0000	0.0000	210.7543	494.1935	784.1603	(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	89.8371	89.7635	89.5786	89.1540	88.3350	87.3000	87.3000	87.3000	87.3000	89.0866	89.6455	89.8635	(216)
(217)m	89.8371	89.7635	89.5786	89.1540	88.3350	87.3000	87.3000	87.3000	87.3000	89.0866	89.6455	89.8635	(217)
Fuel for water heating, kWh/month	194.8730	171.0154	177.8805	157.2878	153.4200	135.5997	127.2799	143.7432	144.7757	163.3765	175.3261	189.1517	(219)
Water heating fuel used	1933.7294											1933.7294	(219)
Annual totals kWh/year													
Space heating fuel - main system												3591.6021	(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												5997.2950	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3591.6021	9.7400	349.8220	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1933.7294	9.7400	188.3452	(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			816.0859	(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	3591.6021	0.2160	775.7860	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1933.7294	0.2160	417.6856	(264)
Space and water heating			1193.4716	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total kg/year			1438.4207	(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	3591.6021	1.2200	4381.7545	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1933.7294	1.2200	2359.1499	(264)
Space and water heating			6740.9044	(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			8189.8325	(272)
Primary energy kWh/m2/year			84.1191	(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 84
Current environmental impact rating: B 85

(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 (13.1%)
U Solar photovoltaic panels	+ 9.4	-£ 672	-947 kg (75.8%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£78	1.94 kg/m²	B 85	B 87
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	£642	£545	£97
Space heating	£481	£481	£0
Water heating	£188	£110	£78
Lighting	£146	£146	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£816	£65	£751
Total cost of uses	£815	£65	£750
Delivered energy	62 kWh/m²	33 kWh/m²	28 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	12 kg/m²
Primary energy	84 kWh/m²	16 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 (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 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	1.3100	10.6334	0.4600	0.0000	0.7700	4.9339 (74)
East	2.6200	19.6403	0.4600	0.0000	0.7700	18.2262 (76)
South	6.7100	46.7521	0.4600	0.0000	0.7700	111.1148 (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	211.5021	375.0659	545.2169	717.3620	833.0672	837.7492	803.3934	716.9548	605.6146	423.8680	256.2022	179.0482 (83)
Total gains	831.7389	990.6395	1136.8943	1271.7929	1349.1218	1319.4917	1265.0963	1187.4566	1097.5551	953.2804	827.3352	781.9788 (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	0.9787	0.9620	0.9293	0.8605	0.7471	0.5895	0.4480	0.4908	0.7059	0.8958	0.9648	0.9823 (86)
MIT	19.2202	19.4877	19.8762	20.3407	20.6933	20.9032	20.9712	20.9605	20.8142	20.3367	19.6987	19.1822 (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	0.9735	0.9529	0.9123	0.8269	0.6872	0.4974	0.3320	0.3726	0.6200	0.8628	0.9548	0.9780 (89)
MIT 2	17.4202	17.8065	18.3601	19.0111	19.4643	19.7103	19.7664	19.7634	19.6234	19.0267	18.1279	17.3754 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)

MIT	17.7852	18.1474	18.6675	19.2807	19.7135	19.9522	20.0107	20.0061	19.8648	19.2923	18.4464	17.7417 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6352	17.9974	18.5175	19.1307	19.5635	19.8022	19.8607	19.8561	19.7148	19.1423	18.2964	17.5917 (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	4337.5104	0.2160	936.9022 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	952.7199	0.2160	205.7875 (264)
Space and water heating			1142.6898 (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			517.1516 (272)
CO2 emissions per m2			5.3100 (273)
EI value			95.1322
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	1.3100	11.9814	0.4600	0.0000	0.7700	5.5594 (74)
East	2.6200	22.3313	0.4600	0.0000	0.7700	20.7236 (76)
South	6.7100	50.9848	0.4600	0.0000	0.7700	121.1747 (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	234.8027	374.9359	539.3593	733.5737	832.2974	896.8812	850.3154	774.1656	650.1218	452.6556	291.4332	196.8312	(83)
Total gains	855.0395	990.5096	1131.0367	1288.0046	1348.3521	1378.6237	1312.0184	1244.6674	1142.0622	982.0680	862.5662	799.7619	(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	0.9732	0.9561	0.9160	0.8255	0.6780	0.4597	0.3099	0.3343	0.6049	0.8577	0.9518	0.9777	(86)
MIT	19.4374	19.6651	20.0560	20.5000	20.8140	20.9659	20.9937	20.9919	20.9080	20.5155	19.9236	19.4036	(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	0.9665	0.9455	0.8953	0.7839	0.6046	0.3573	0.1909	0.2112	0.5025	0.8129	0.9378	0.9720	(89)
MIT 2	17.7556	18.0847	18.6352	19.2388	19.6204	19.7759	19.7893	19.7943	19.7331	19.2815	18.4698	17.7159	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)

FULL SAP CALCULATION PRINTOUT

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

MIT	18.0966	18.4051	18.9232	19.4945	19.8624	20.0172	20.0335	20.0371	19.9713	19.5317	18.7645	18.0581 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9466	18.2551	18.7732	19.3445	19.7124	19.8672	19.8835	19.8871	19.8213	19.3817	18.6145	17.9081 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9522	0.9275	0.8740	0.7665	0.6000	0.3639	0.2002	0.2207	0.5051	0.7946	0.9193	0.9593 (94)	
Useful gains	814.1906	918.6622	988.4899	987.2775	809.0477	501.6220	262.6857	274.6655	576.8692	780.3579	792.9470	767.1869 (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	1747.7351	1710.8202	1537.5279	1265.3674	899.3175	512.4523	263.5372	275.8599	612.3815	1036.7190	1414.1209	1721.0379 (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	694.5571	532.3302	408.4843	200.2247	67.1607	0.0000	0.0000	0.0000	0.0000	190.7327	447.2451	709.6651 (98)	
Space heating												3250.3999 (98)	
Space heating per m2												(98) / (4) = 33.3854 (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													3591.6021 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	694.5571	532.3302	408.4843	200.2247	67.1607	0.0000	0.0000	0.0000	0.0000	190.7327	447.2451	709.6651 (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)	767.4664	588.2101	451.3638	221.2428	74.2107	0.0000	0.0000	0.0000	0.0000	210.7543	494.1935	784.1603 (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	89.9215	89.9244	89.9025	89.8950	89.7203	87.3000	87.3000	87.3000	87.3000	89.4512	89.7852	89.9329 (217)	
Fuel for water heating, kWh/month	164.4327	125.2341	100.6347	50.0910	23.2633	0.0000	0.0000	23.2759	50.7505	100.2854	138.2189	163.9403 (219)	
Water heating fuel used												940.1266 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3591.6021 (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												3229.5326 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3591.6021	9.7400	349.8220 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	940.1266	9.7400	91.5683 (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			65.5311 (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	3591.6021	0.2160	775.7860 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	940.1266	0.2160	203.0673 (264)	

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Space and water heating			978.8534 (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			303.0136 (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	3591.6021	1.2200	4381.7545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	940.1266	1.2200	1146.9544 (264)
Space and water heating			5528.7090 (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			1530.9669 (272)
Primary energy kWh/m2/year			15.7248 (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	South
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	1.3100	81.1852	0.4600	0.0000	0.9000	44.0300
East	2.6200	117.5071	0.4600	0.0000	0.9000	127.4576
South	6.7100	112.2060	0.4600	0.0000	0.9000	311.7015
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:						993.8752

Solar gains	Jun 1048	Jul 994	Aug 905	(P4)
Internal gains	479	459	468	
Total summer gains	1527	1453	1372	(P5)
Summer gain/loss ratio	3.66	3.48	3.29	(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	20.41	22.13	21.84	(P7)
Likelihood of high internal temperature	Not significant	Medium	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:

Medium