

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-146				Issued on Date	13/06/2019
Assessment Reference	As Built	Prop Type Ref	P508 - Det (As)			
Property	49, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	12.68	TER	15.30	
Environmental	88 B	% DER<TER	17.11			
CO ₂ Emissions (t/year)	1.49	DFEE	46.40	TFEE	52.97	
General Requirements Compliance	Pass	% DFEE<TFEE	12.40			
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 145 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) 15.30 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.68 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.36 (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:	4.80 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Potterton Ultra 15 Heat 15

Efficiency: 89.2% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.42 kWh/day

Permitted by DBSCG 2.30 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

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 (Southern England): Slight OK

Based on:

Overshading: Average

Windows facing North: 3.21 m², No overhang

Windows facing North East: 0.57 m², No overhang

Windows facing South East: 10.10 m², No overhang

Windows facing South West: 1.13 m², No overhang

Windows facing West: 3.21 m², No overhang

Windows facing North West: 8.16 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K

Thermal bridging y-value 0.038 W/m²K

Photovoltaic array 0.81 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3016 (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	0.3846	0.3770	0.3695	0.3318	0.3242	0.2865	0.2865	0.2790	0.3016	0.3242	0.3393	0.3544 (22b)
Effective ac	0.5739	0.5711	0.5683	0.5550	0.5526	0.5410	0.5410	0.5389	0.5455	0.5526	0.5576	0.5628 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	65.9735	65.6435	65.3200	63.8005	63.5162	62.1928	62.1928	61.9477	62.7026	63.5162	64.0913	64.6926 (38)
Heat transfer coeff	170.6289	170.2989	169.9754	168.4559	168.1716	166.8482	166.8482	166.6031	167.3580	168.1716	168.7467	169.3480 (39)
Average = Sum(39)m / 12 =												168.4545 (39)
HLP	1.1732	1.1709	1.1687	1.1583	1.1563	1.1472	1.1472	1.1455	1.1507	1.1563	1.1602	1.1644 (40)
HLP (average)												1.1582 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7668 (55)
Total storage loss												
	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage												
	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month												
	216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764 (59)
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	216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764 (64)
								Total per year (kWh/year) =	Sum(64)m =			2185.5656 (64)
Heat gains from water heating, kWh/month												
	93.8794	83.1844	88.3956	80.6745	80.0967	73.0613	71.5868	76.5964	75.8481	83.5846	86.5796	92.1044 (65)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 38.2664 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6170.1339 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1063.4929	839.9601	715.6319	432.6343	218.3770	0.0000	0.0000	0.0000	0.0000	436.3537	771.4679	1087.5431	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	1179.0386	931.2197	793.3835	479.6389	242.1031	0.0000	0.0000	0.0000	0.0000	483.7624	855.2859	1205.7019	(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	216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764	(64)
Efficiency of water heater (217)m	88.1945	88.0106	87.6267	86.7865	85.1080	79.5000	79.5000	79.5000	79.5000	86.7215	87.8021	79.5000	(216)
Fuel for water heating, kWh/month	245.1568	216.3930	227.9238	205.8314	205.3426	195.8957	187.6342	206.5859	206.4382	213.6181	223.6775	238.8980	(219)
Water heating fuel used												2573.3951	(219)
Annual totals kWh/year													
Space heating fuel - main system												6170.1339	(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)												506.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												8658.3717	(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	6170.1339	0.2160	1332.7489 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2573.3951	0.2160	555.8533 (264)
Space and water heating			1888.6023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	506.7557	0.5190	263.0062 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total CO2, kg/year			1844.4056 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6800 (273)

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

DER		12.6800	ZC1
Total Floor Area		145.4400	
Assumed number of occupants		2.9268	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		12.8554	ZC2
CO2 emissions from cooking, equation (L16)		1.3012	ZC3
Total CO2 emissions		26.8366	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		26.8366	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (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																4 * 10 =	40.0000 (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) =					40.0000	/ (5) =	0.1148 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3648 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3101 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644 (22b)					
Effective ac	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			26.3800	1.3258	34.9735		(27)					
Heat Loss Floor 1			72.7200	0.1300	9.4536		(28a)					
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.1800	25.4772		(29a)					
External Roof 1	72.7200		72.7200	0.1300	9.4536		(30)					
Total net area of external elements Aum(A, m2)			315.4900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	81.4879		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.9011 (36)					
Total fabric heat loss						(33) + (36) =	95.3890 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.4593	Feb 66.1104	Mar 65.7684	Apr 64.1621	May 63.8616	Jun 62.4625	Jul 62.4625	Aug 62.2034	Sep 63.0014	Oct 63.8616	Nov 64.4696	Dec 65.1052 (38)
Heat transfer coeff	161.8483	161.4994	161.1574	159.5511	159.2506	157.8515	157.8515	157.5924	158.3904	159.2506	159.8585	160.4942 (39)
Average = Sum(39)m / 12 =												159.5497 (39)
HLP	Jan 1.1128	Feb 1.1104	Mar 1.1081	Apr 1.0970	May 1.0950	Jun 1.0853	Jul 1.0853	Aug 1.0836	Sep 1.0890	Oct 1.0950	Nov 1.0991	Dec 1.1035 (40)
HLP (average)												1.0970 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	Jan 114.0828	Feb 109.9343	Mar 105.7858	Apr 101.6374	May 97.4889	Jun 93.3405	Jul 93.3405	Aug 97.4889	Sep 101.6374	Oct 105.7858	Nov 109.9343	Dec 114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316		24.5765 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	220.9281	194.7060	204.4355	183.1952	179.4764	160.2984	153.8826	168.9492	168.6797	189.9662	200.9549	215.5898 (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	220.9281	194.7060	204.4355	183.1952	179.4764	160.2984	153.8826	168.9492	168.6797	189.9662	200.9549	215.5898 (64)
Heat gains from water heating, kWh/month	97.6501	86.5902	92.1663	84.3236	83.8674	76.7104	75.3575	80.3671	79.4972	87.3553	90.2286	95.8751 (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	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6946	25.4863	20.7268	15.6916	11.7296	9.9026	10.7002	13.9085	18.6679	23.7032	27.6651	29.4921	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.5169	318.7910	310.5404	292.9759	270.8039	249.9654	236.0439	232.7698	241.0204	258.5849	280.7569	301.5955	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	(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)	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	(71)
Water heating gains (Table 5)	131.2501	128.8544	123.8795	117.1161	112.7250	106.5422	101.2870	108.0203	110.4127	117.4130	125.3176	128.8644	(72)
Total internal gains	545.3638	543.0338	525.0488	495.6856	465.1607	436.3123	417.9331	424.6007	440.0031	469.6032	503.6417	529.8541	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2100	10.6334	0.6300	0.7000	0.7700	10.4315	(74)
Northeast	0.5700	11.2829	0.6300	0.7000	0.7700	1.9655	(75)
Southeast	10.1000	36.7938	0.6300	0.7000	0.7700	113.5712	(77)
Southwest	1.1300	36.7938	0.6300	0.7000	0.7700	12.7065	(79)
West	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674	(80)
Northwest	8.1600	11.2829	0.6300	0.7000	0.7700	28.1374	(81)

Solar gains	186.0796	333.9994	500.6515	690.9057	836.4035	857.3572	815.3838	703.0408	566.1145	381.0661	226.0217	157.1918	(83)
Total gains	731.4433	877.0332	1025.7003	1186.5913	1301.5641	1293.6694	1233.3170	1127.6415	1006.1176	850.6693	729.6634	687.0459	(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	62.4041	62.5389	62.6716	63.3026	63.4221	63.9842	63.9842	64.0894	63.7665	63.4221	63.1809	62.9306
alpha	5.1603	5.1693	5.1781	5.2202	5.2281	5.2656	5.2656	5.2726	5.2511	5.2281	5.2121	5.1954
util living area	0.9991	0.9976	0.9921	0.9681	0.8884	0.7218	0.5509	0.6190	0.8726	0.9848	0.9980	0.9994 (86)
MIT	19.7179	19.8779	20.1416	20.4902	20.7882	20.9501	20.9901	20.9824	20.8597	20.4661	20.0263	19.6912 (87)
Th 2	19.9904	19.9923	19.9942	20.0033	20.0050	20.0128	20.0128	20.0143	20.0098	20.0050	20.0015	19.9980 (88)
util rest of house	0.9988	0.9967	0.9891	0.9556	0.8461	0.6332	0.4336	0.4982	0.8082	0.9769	0.9971	0.9992 (89)
MIT 2	18.2679	18.5031	18.8885	19.3943	19.7935	19.9791	20.0091	20.0068	19.8923	19.3680	18.7273	18.2343 (90)
Living area fraction	18.4635	18.6886	19.0576	19.5421	19.9277	20.1101	20.1414	20.1384	20.0228	19.5161	18.9025	18.4308 (91)
MIT	18.4635	18.6886	19.0576	19.5421	19.9277	20.1101	20.1414	20.1384	20.0228	19.5161	18.9025	18.4308 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4635	18.6886	19.0576	19.5421	19.9277	20.1101	20.1414	20.1384	20.0228	19.5161	18.9025	18.4308 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9981	0.9951	0.9852	0.9480	0.8422	0.6426	0.4494	0.5142	0.8092	0.9713	0.9957	0.9986	(94)
Ext temp.	730.0704	872.7168	1010.4828	1124.9080	1096.2046	831.3427	554.2483	579.8131	814.1955	826.2465	726.4900	686.1097	(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	2292.3441	2226.8493	2023.7469	1697.9649	1310.2629	869.7699	559.0209	589.1478	938.1113	1419.8969	1886.7311	2283.9649	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1162.3316	909.9770	753.8685	412.6009	159.2594	0.0000	0.0000	0.0000	0.0000	441.6759	835.3737	1188.8043	(98)
Space heating per m ²												5863.8912	(98)
												40.3183	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6271.5414	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1162.3316	909.9770	753.8685	412.6009	159.2594	0.0000	0.0000	0.0000	0.0000	441.6759	835.3737	1188.8043	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1243.1354	973.2374	806.2764	441.2844	170.3309	0.0000	0.0000	0.0000	0.0000	472.3806	893.4478	1271.4485	(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	220.9281	194.7060	204.4355	183.1952	179.4764	160.2984	153.8826	168.9492	168.6797	189.9662	200.9549	215.5898	(64)	
Efficiency of water heater (217)m	88.6025	88.4106	87.9833	86.9166	84.4970	79.8000	79.8000	79.8000	79.8000	86.9920	88.2066	88.6748	(216)	
Fuel for water heating, kWh/month	249.3473	220.2294	232.3572	210.7714	212.4056	200.8752	192.8354	211.7158	211.3781	218.3722	227.8230	243.1242	(219)	
Water heating fuel used												2631.2346	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6271.5414	(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)													506.7557	(232)
Total delivered energy for all uses													9484.5317	(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	6271.5414	0.2160	1354.6529 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2631.2346	0.2160	568.3467 (264)
Space and water heating			1922.9996 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	506.7557	0.5190	263.0062 (268)
Total CO2, kg/m2/year			2224.9308 (272)
Emissions per m2 for space and water heating			13.2219 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8083 (272b)
Emissions per m2 for pumps and fans			0.2676 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2219 * 1.00) + 1.8083 + 0.2676, rounded to 2 d.p.			15.3000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3016 (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	0.3846	0.3770	0.3695	0.3318	0.3242	0.2865	0.2865	0.2790	0.3016	0.3242	0.3393	0.3544 (22b)
Effective ac	0.5739	0.5711	0.5683	0.5550	0.5526	0.5410	0.5410	0.5389	0.5455	0.5526	0.5576	0.5628 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			9.0000	654.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16564.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							113.8911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (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	65.9735	65.6435	65.3200	63.8005	63.5162	62.1928	62.1928	61.9477	62.7026	63.5162	64.0913	64.6926 (38)
Heat transfer coeff	170.6289	170.2989	169.9754	168.4559	168.1716	166.8482	166.8482	166.6031	167.3580	168.1716	168.7467	169.3480 (39)
Average = Sum(39)m / 12 =												168.4545 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1732	1.1709	1.1687	1.1583	1.1563	1.1472	1.1472	1.1455	1.1507	1.1563	1.1602	1.1644 (40)
HLP (average)												1.1582 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.9511	31.4430	32.4464	28.2875	27.1426	23.4220	21.7039	24.9055	25.2030	29.3717	32.0615	34.8167	(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	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6946	25.4863	20.7268	15.6916	11.7296	9.9026	10.7002	13.9085	18.6679	23.7032	27.6651	29.4921	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.5169	318.7910	310.5404	292.9759	270.8039	249.9654	236.0439	232.7698	241.0204	258.5849	280.7569	301.5955	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	(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)	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	(71)
Water heating gains (Table 5)	48.3213	46.7902	43.6107	39.2883	36.4820	32.5305	29.1719	33.4752	35.0042	39.4780	44.5298	46.7966	(72)
Total internal gains	459.4349	457.9696	441.7801	414.8578	385.9176	359.3006	342.8181	347.0556	361.5946	388.6682	419.8540	444.7863	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North				3.2100	10.6334	0.7100	0.7000				0.7700			11.7562 (74)
Northeast				0.5700	11.2829	0.7100	0.7000				0.7700			2.2151 (75)
Southeast				6.0000	36.7938	0.7100	0.7000				0.7700			76.0354 (77)
Southwest				1.1300	36.7938	0.7100	0.7000				0.7700			14.3200 (79)
West				3.2100	19.6403	0.7100	0.7000				0.7700			21.7141 (80)
Northwest				8.1600	11.2829	0.7100	0.7000				0.7700			31.7104 (81)
Southeast				4.1000	36.7938	0.7100	0.7000				0.7700			51.9575 (77)
Solar gains	209.7087	376.4120	564.2263	778.6397	942.6135	966.2279	918.9247	792.3159	638.0020	429.4554	254.7229	177.1527	(83)	
Total gains	669.1437	834.3816	1006.0063	1193.4976	1328.5310	1325.5285	1261.7427	1139.3714	999.5966	818.1236	674.5768	621.9389	(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	26.9661	27.0184	27.0698	27.3140	27.3601	27.5772	27.5772	27.6177	27.4932	27.3601	27.2669	27.1701		
alpha	2.7977	2.8012	2.8047	2.8209	2.8240	2.8385	2.8385	2.8412	2.8329	2.8240	2.8178	2.8113		
util living area	0.9867	0.9749	0.9504	0.8948	0.7954	0.6552	0.5221	0.5814	0.7898	0.9341	0.9785	0.9891	(86)	
MIT	18.5364	18.8284	19.3000	19.9028	20.4261	20.7738	20.9144	20.8820	20.5860	19.8859	19.0955	18.4836	(87)	
Th 2	19.9415	19.9433	19.9451	19.9535	19.9551	19.9625	19.9625	19.9638	19.9596	19.9551	19.9519	19.9486	(88)	
util rest of house	0.9843	0.9705	0.9414	0.8747	0.7545	0.5827	0.4187	0.4785	0.7320	0.9175	0.9740	0.9872	(89)	
MIT 2	17.6793	17.9702	18.4369	19.0286	19.5185	19.8236	19.9254	19.9087	19.6775	19.0244	18.2438	17.6318	(90)	
Living area fraction	17.7949	18.0860	18.5534	19.1465	19.6410	19.9518	20.0588	20.0400	19.8000	19.1406	18.3587	17.7467	(92)	
Temperature adjustment	17.7949	18.0860	18.5534	19.1465	19.6410	19.9518	20.0588	20.0400	19.8000	19.1406	18.3587	17.7467	(93)	
adjusted MIT	17.7949	18.0860	18.5534	19.1465	19.6410	19.9518	20.0588	20.0400	19.8000	19.1406	18.3587	17.7467	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	654.0482	800.8538	931.3650	1021.4256	983.6552	771.2810	541.3231	554.5512	721.2960	736.8237	650.5983	610.3038	(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	2302.6274	2245.5589	2048.7751	1726.0865	1335.4455	892.9424	577.0974	606.4286	953.9453	1436.2894	1899.8718	2294.1075	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1226.5429	970.8418	831.3531	507.3559	261.7320	0.0000	0.0000	0.0000	0.0000	520.4025	899.4769	1252.7500	(98)
Space heating												6470.4552	(98)
Space heating per m2												44.4888	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1568.3730	1234.6766	1266.1837	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7630	0.8257	0.7888	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1196.7020	1019.5005	998.8117	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1673.7508	1596.3182	1455.7712	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	343.4751	429.1523	339.9779	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1112.6053 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	85.8688	107.2881	84.9945	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												278.1513 (107)
Energy for space heating												1.9125 (108)
Energy for space cooling												44.4888 (99)
Total												1.9125 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.4013 (109)
												46.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3648 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3101 (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	0.3954	0.3876	0.3799	0.3411	0.3334	0.2946	0.2946	0.2869	0.3101	0.3334	0.3489	0.3644 (22b)
Effective ac	0.5782	0.5751	0.5722	0.5582	0.5556	0.5434	0.5434	0.5411	0.5481	0.5556	0.5609	0.5664 (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 Opening Type (Uw = 1.40)			26.3800	1.3258	34.9735		(27)
Heat Loss Floor 1			72.7200	0.1300	9.4536		(28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.1800	25.4772		(29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536		(30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4879		(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)							13.9011 (36)
Total fabric heat loss						(33) + (36) =	95.3890 (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	66.4593	66.1104	65.7684	64.1621	63.8616	62.4625	62.4625	62.2034	63.0014	63.8616	64.4696	65.1052 (38)
Heat transfer coeff	161.8483	161.4994	161.1574	159.5511	159.2506	157.8515	157.8515	157.5924	158.3904	159.2506	159.8585	160.4942 (39)
Average = Sum(39)m / 12 =												159.5497 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1128	1.1104	1.1081	1.0970	1.0950	1.0853	1.0853	1.0836	1.0890	1.0950	1.0991	1.1035 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.9511	31.4430	32.4464	28.2875	27.1426	23.4220	21.7039	24.9055	25.2030	29.3717	32.0615	34.8167 (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	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	146.3402	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6946	25.4863	20.7268	15.6916	11.7296	9.9026	10.7002	13.9085	18.6679	23.7032	27.6651	29.4921	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	315.5169	318.7910	310.5404	292.9759	270.8039	249.9654	236.0439	232.7698	241.0204	258.5849	280.7569	301.5955	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	37.6340	(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)	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	(71)
Water heating gains (Table 5)	48.3213	46.7902	43.6107	39.2883	36.4820	32.5305	29.1719	33.4752	35.0042	39.4780	44.5298	46.7966	(72)
Total internal gains	459.4349	457.9696	441.7801	414.8578	385.9176	359.3006	342.8181	347.0556	361.5946	388.6682	419.8540	444.7863	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.2100	10.6334	0.6300	0.7000	0.7700	10.4315 (74)
Northeast	0.5700	11.2829	0.6300	0.7000	0.7700	1.9655 (75)
Southeast	10.1000	36.7938	0.6300	0.7000	0.7700	113.5712 (77)
Southwest	1.1300	36.7938	0.6300	0.7000	0.7700	12.7065 (79)
West	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (80)
Northwest	8.1600	11.2829	0.6300	0.7000	0.7700	28.1374 (81)

Solar gains	186.0796	333.9994	500.6515	690.9057	836.4035	857.3572	815.3838	703.0408	566.1145	381.0661	226.0217	157.1918	(83)
Total gains	645.5145	791.9690	942.4316	1105.7635	1222.3211	1216.6578	1158.2019	1050.0964	927.7090	769.7343	645.8757	601.9781	(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	62.4041	62.5389	62.6716	63.3026	63.4221	63.9842	63.9842	64.0894	63.7665	63.4221	63.1809	62.9306	
alpha	5.1603	5.1693	5.1781	5.2202	5.2281	5.2656	5.2656	5.2726	5.2511	5.2281	5.2121	5.1954	
util living area	0.9995	0.9985	0.9946	0.9760	0.9082	0.7534	0.5827	0.6568	0.9003	0.9902	0.9989	0.9997	(86)
MIT	19.6622	19.8231	20.0894	20.4449	20.7581	20.9388	20.9872	20.9769	20.8317	20.4168	19.9722	19.6359	(87)
Th 2	19.9904	19.9923	19.9942	20.0033	20.0050	20.0128	20.0128	20.0143	20.0098	20.0050	20.0015	19.9980	(88)
util rest of house	0.9994	0.9980	0.9925	0.9661	0.8706	0.6658	0.4607	0.5323	0.8438	0.9848	0.9984	0.9996	(89)
MIT 2	18.7588	18.9211	19.1878	19.5447	19.8364	19.9838	20.0095	20.0074	19.9097	19.5225	19.0776	18.7386	(90)
Living area fraction									fLA = Living area / (4) =			0.1349	(91)
MIT	18.8807	19.0428	19.3094	19.6661	19.9607	20.1126	20.1413	20.1382	20.0341	19.6431	19.1983	18.8597	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8807	19.0428	19.3094	19.6661	19.9607	20.1126	20.1413	20.1382	20.0341	19.6431	19.1983	18.8597	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	644.9309	789.7984	933.5282	1063.5132	1061.7325	821.8301	552.6993	576.4949	784.3418	755.9057	644.4580	601.6017	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2359.8550	2284.0460	2064.3336	1717.7506	1315.5265	870.1789	559.0072	589.1062	939.9012	1440.1197	1934.0125	2352.7888	(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	1275.9036	1004.1344	841.3192	471.0509	188.8228	0.0000	0.0000	0.0000	0.0000	509.0552	928.4793	1302.8832	(98)
Space heating												6521.6487	(98)
Space heating per m2												(98) / (4) =	44.8408 (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	1483.8041	1168.1011	1197.7023	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8573	0.9207	0.8867	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1272.0128	1075.5286	1062.0037	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1546.4993	1475.2964	1351.4238	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	197.6303	297.4273	215.3286	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												710.3861 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	49.4076	74.3568	53.8321	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												177.5965 (107)
Space cooling per m2												1.2211 (108)
Energy for space heating												44.8408 (99)
Energy for space cooling												1.2211 (108)
Total												46.0619 (109)
Target Fabric Energy Efficiency (TFEE)												53.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 348.3288 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3016 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3167	0.2941	0.3016	0.2865	0.2865	0.2790	0.2714	0.2639	0.2564	0.2790	0.2639	0.2790 (22b)
	0.5501	0.5432	0.5455	0.5410	0.5410	0.5389	0.5368	0.5348	0.5329	0.5389	0.5348	0.5389 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.2385	62.4444	62.7026	62.1928	62.1928	61.9477	61.7092	61.4772	61.2517	61.9477	61.4772	61.9477 (38)
Heat transfer coeff	167.8939	167.0998	167.3580	166.8482	166.8482	166.6031	166.3646	166.1326	165.9071	166.6031	166.1326	166.6031 (39)
Average = Sum(39)m / 12 =												166.6995 (39)
HLP	1.1544	1.1489	1.1507	1.1472	1.1472	1.1455	1.1439	1.1423	1.1407	1.1455	1.1423	1.1455 (40)
HLP (average)												1.1462 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)												1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	4270.4801 (98)
RHI space heating demand	4270 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3016 (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	0.3846	0.3770	0.3695	0.3318	0.3242	0.2865	0.2865	0.2790	0.3016	0.3242	0.3393	0.3544 (22b)
Effective ac	0.5739	0.5711	0.5683	0.5550	0.5526	0.5410	0.5410	0.5389	0.5455	0.5526	0.5576	0.5628 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	65.9735	65.6435	65.3200	63.8005	63.5162	62.1928	62.1928	61.9477	62.7026	63.5162	64.0913	64.6926 (38)
Heat transfer coeff	170.6289	170.2989	169.9754	168.4559	168.1716	166.8482	166.8482	166.6031	167.3580	168.1716	168.7467	169.3480 (39)
Average = Sum(39)m / 12 =												168.4545 (39)
HLP	1.1732	1.1709	1.1687	1.1583	1.1563	1.1472	1.1472	1.1455	1.1507	1.1563	1.1602	1.1644 (40)
HLP (average)												1.1582 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)												1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

Water storage loss:											
Store volume											
a) If manufacturer declared loss factor is known (kWh/day):											
Temperature factor from Table 2b											
Enter (49) or (54) in (55)											
Total storage loss											
23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage											
23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (57)
Primary loss											
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month											
216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764 (64)
Total per year (kWh/year) = Sum(64)m = 2185.5656 (64)											
Heat gains from water heating, kWh/month											
93.8794	83.1844	88.3956	80.6745	80.0967	73.0613	71.5868	76.5964	75.8481	83.5846	86.5796	92.1044 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7365	63.7157	51.8171	39.2289	29.3241	24.7566	26.7504	34.7712	46.6698	59.2580	69.1628	73.7303 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.9208	475.8075	463.4932	437.2775	404.1850	373.0826	352.3044	347.4177	359.7320	385.9476	419.0402	450.1425 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876 (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)	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722 (71)
Water heating gains (Table 5)	126.1820	123.7863	118.8113	112.0479	107.6569	101.4740	96.2188	102.9522	105.3446	112.3449	120.2494	123.7963 (72)
Total internal gains	785.8630	780.3332	751.1453	705.5781	658.1896	616.3370	592.2973	602.1647	628.7700	674.5742	725.4762	764.6928 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.2100	10.6334	0.7100	0.7000	0.7700	11.7562 (74)
Northeast	0.5700	11.2829	0.7100	0.7000	0.7700	2.2151 (75)
Southeast	6.0000	36.7938	0.7100	0.7000	0.7700	76.0354 (77)
Southwest	1.1300	36.7938	0.7100	0.7000	0.7700	14.3200 (79)
West	3.2100	19.6403	0.7100	0.7000	0.7700	21.7141 (80)
Northwest	8.1600	11.2829	0.7100	0.7000	0.7700	31.7104 (81)
Southeast	4.1000	36.7938	0.7100	0.7000	0.7700	51.9575 (77)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0316	28.0859	28.1394	28.3932	28.4412	28.6668	28.6668	28.7089	28.5795	28.4412	28.3443	28.2436
alpha	2.8688	2.8724	2.8760	2.8929	2.8961	2.9111	2.9111	2.9139	2.9053	2.8961	2.8896	2.8829
util living area	0.9676	0.9498	0.9160	0.8469	0.7346	0.5858	0.4533	0.5017	0.7086	0.8833	0.9516	0.9720 (86)
MIT	18.9288	19.1944	19.6148	20.1380	20.5717	20.8443	20.9457	20.9261	20.7156	20.1458	19.4424	18.8754 (87)
Th 2	19.9415	19.9433	19.9451	19.9535	19.9551	19.9625	19.9625	19.9638	19.9596	19.9551	19.9519	19.9486 (88)
util rest of house	0.9621	0.9414	0.9018	0.8204	0.6883	0.5130	0.3579	0.4047	0.6426	0.8571	0.9421	0.9672 (89)
MIT 2	17.1896	17.5728	18.1749	18.9125	19.4920	19.8282	19.9298	19.9162	19.6899	18.9414	17.9411	17.1167 (90)
Living area fraction									f _{LA} = Living area / (4)			0.1349 (91)
MIT	17.4243	17.7916	18.3691	19.0778	19.6376	19.9652	20.0669	20.0524	19.8282	19.1039	18.1436	17.3539 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2743	17.6416	18.2191	18.9278	19.4876	19.8152	19.9169	19.9024	19.6782	18.9539	17.9936	17.2039 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 33.6794 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5430.5187 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	949.4793	746.1190	629.3729	373.0413	182.6326	0.0000	0.0000	0.0000	0.0000	367.5825	676.4207	973.6795 (98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)	
Space heating fuel (main heating system)	1052.6378	827.1829	697.7526	413.5713	202.4752	0.0000	0.0000	0.0000	0.0000	407.5194	749.9121	1079.4673 (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	216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764 (64)	
Efficiency of water heater (217)m	88.0031	87.7971	87.3674	86.4332	84.6302	79.5000	79.5000	79.5000	79.5000	86.3075	87.5486	79.5000 (216)	
Fuel for water heating, kWh/month	245.6899	216.9192	228.6003	206.6728	206.5020	195.8957	187.6342	206.5859	206.4382	214.6429	224.3251	239.3892 (219)	
Water heating fuel used												2579.2954 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5430.5187 (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)												506.7557 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.81 + 1029 + 1.00) =										-666.9130		-666.9130 (233)	
Total delivered energy for all uses												7924.6568 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5430.5187	3.4800	188.9821 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	2579.2954	3.4800	89.7595 (247)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Energy for lighting	506.7557	13.1900	66.8411 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658 (252)	
Total energy cost			387.5093 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8546 (257)
SAP value		88.0780
SAP rating (Section 12)		88 (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	5430.5187	0.2160	1172.9920 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2579.2954	0.2160	557.1278 (264)	
Space and water heating			1730.1198 (265)	
Pumps and fans	75.0000	0.5190	38.9250 (267)	
Energy for lighting	506.7557	0.5190	263.0062 (268)	
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278 (269)	
Total kg/year			1685.9232 (272)	
CO2 emissions per m2			11.5900 (273)	
EI value			88.1373	
EI rating			88 (274)	
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
 $3.48 / 0.8451 = 4.118$, stars = 4
 $0.216 / 0.8451 = 0.2556$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3016 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3167	0.2941	0.3016	0.2865	0.2865	0.2790	0.2714	0.2639	0.2564	0.2790	0.2639	0.2790 (22b)
	0.5501	0.5432	0.5455	0.5410	0.5410	0.5389	0.5368	0.5348	0.5329	0.5389	0.5348	0.5389 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.2385	62.4444	62.7026	62.1928	62.1928	61.9477	61.7092	61.4772	61.2517	61.9477	61.4772	61.9477 (38)
Heat transfer coeff	167.8939	167.0998	167.3580	166.8482	166.8482	166.6031	166.3646	166.1326	165.9071	166.6031	166.1326	166.6031 (39)
Average = Sum(39)m / 12 =												166.6995 (39)
HLP	1.1544	1.1489	1.1507	1.1472	1.1472	1.1455	1.1439	1.1423	1.1407	1.1455	1.1423	1.1455 (40)
HLP (average)												1.1462 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)												1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7668	(55)
Total storage loss													
23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	(56)
If cylinder contains dedicated solar storage													
23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month													
216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764	210.8764	(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													
216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764	210.8764	(64)
Heat gains from water heating, kWh/month													
93.8794	83.1844	88.3956	80.6745	80.0967	73.0613	71.5868	76.5964	75.8481	83.5846	86.5796	92.1044	92.1044	(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	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	175.6083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
71.7365	63.7157	51.8171	39.2289	29.3241	24.7566	26.7504	34.7712	46.6698	59.2580	69.1628	73.7303	73.7303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
470.9208	475.8075	463.4932	437.2775	404.1850	373.0826	352.3044	347.4177	359.7320	385.9476	419.0402	450.1425	450.1425	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	55.4876	(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)													
-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	-117.0722	(71)
Water heating gains (Table 5)													
126.1820	123.7863	118.8113	112.0479	107.6569	101.4740	96.2188	102.9522	105.3446	112.3449	120.2494	123.7963	123.7963	(72)
Total internal gains													
785.8630	780.3332	751.1453	705.5781	658.1896	616.3370	592.2973	602.1647	628.7700	674.5742	725.4762	764.6928	764.6928	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				

North						3.2100	13.4839		0.7100	0.7000	0.7700		14.9077 (74)				
Northeast						0.5700	14.6176		0.7100	0.7000	0.7700		2.8697 (75)				
Southeast						6.0000	45.1778		0.7100	0.7000	0.7700		93.3611 (77)				
Southwest						1.1300	45.1778		0.7100	0.7000	0.7700		17.5830 (79)				
West						3.2100	25.1925		0.7100	0.7000	0.7700		27.8527 (80)				
Northwest						8.1600	14.6176		0.7100	0.7000	0.7700		41.0825 (81)				
Southeast						4.1000	45.1778		0.7100	0.7000	0.7700		63.7968 (77)				

Solar gains						261.4536	400.7761	609.1176	850.7199	981.7744	1094.0236	1032.0140	910.0024	729.2965	494.3532	316.8285	216.9352 (83)
Total gains						1047.3166	1181.1093	1360.2629	1556.2979	1639.9641	1710.3606	1624.3113	1512.1672	1358.0665	1168.9274	1042.3046	981.6280 (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	28.4882	28.6236	28.5795	28.6668	28.6668	28.7089	28.7501	28.7903	28.8294	28.7089	28.7903	28.7089		
alpha	2.8992	2.9082	2.9053	2.9111	2.9111	2.9139	2.9167	2.9194	2.9220	2.9139	2.9194	2.9139		
util living area	0.9598	0.9435	0.9018	0.8163	0.6880	0.5058	0.3825	0.4071	0.6411	0.8473	0.9357	0.9649	(86)	
MIT	19.1247	19.3304	19.7656	20.2823	20.6791	20.9064	20.9695	20.9641	20.8064	20.3255	19.6683	19.0967	(87)	
Th 2	19.9567	19.9611	19.9596	19.9625	19.9625	19.9638	19.9652	19.9665	19.9677	19.9638	19.9665	19.9638	(88)	
util rest of house	0.9530	0.9341	0.8853	0.7854	0.6349	0.4282	0.2876	0.3074	0.5666	0.8134	0.9229	0.9588	(89)	
MIT	17.4818	17.7790	18.3974	19.1139	19.6319	19.8915	19.9497	19.9481	19.7980	19.1916	18.2733	17.4465	(90)	
Living area fraction									fLA = Living area / (4) =			0.1349	(91)	
MIT	17.7034	17.9883	18.5819	19.2715	19.7732	20.0284	20.0873	20.0852	19.9340	19.3446	18.4615	17.6691	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.5534	17.8383	18.4319	19.1215	19.6232	19.8784	19.9373	19.9352	19.7840	19.1946	18.3115	17.5191	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9303	0.9078	0.8543	0.7557	0.6156	0.4214	0.2849	0.3043	0.5519	0.7823	0.8950	0.9379	(94)	
Useful gains	974.3670	1072.2193	1162.0092	1176.1652	1009.5567	720.8174	462.8447	460.1328	749.4881	914.3950	932.8551	920.6329	(95)	
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)	
Heat loss rate W	2124.4256	2095.1484	1913.2254	1605.3274	1188.4939	762.7803	472.0262	471.0125	843.4737	1298.6048	1729.6918	2085.7171	(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														
855.6436	687.4083	558.9049	308.9968	133.1293	0.0000	0.0000	0.0000	0.0000	285.8521	573.7224	866.8227	4270.4801	(98)	
Space heating														

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating per m2 (98) / (4) = 29.3625 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4734.4568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	855.6436	687.4083	558.9049	308.9968	133.1293	0.0000	0.0000	0.0000	0.0000	285.8521	573.7224	866.8227	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	948.6071	762.0935	619.6285	342.5685	147.5935	0.0000	0.0000	0.0000	0.0000	316.9092	636.0559	961.0007	(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	216.2147	190.4488	199.7221	178.6339	174.7630	155.7371	149.1692	164.2358	164.1184	185.2528	196.3935	210.8764	(64)
Efficiency of water heater (217)m	87.8158	87.6410	87.1133	85.9617	83.7982	79.5000	79.5000	79.5000	79.5000	85.6661	87.2068	79.5000	(216)
Fuel for water heating, kWh/month	246.2138	217.3057	229.2671	207.8064	208.5522	195.8957	187.6342	206.5859	206.4382	216.2499	225.2044	239.9446	(219)
Water heating fuel used												2587.0980	(219)
Annual totals kWh/year													
Space heating fuel - main system												4734.4568	(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)												506.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												7154.0731	(238)

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4734.4568	3.9200	185.5907 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2587.0980	3.9200	101.4142 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	506.7557	16.9600	85.9458 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-749.2375	16.9600	-127.0707 (252)
Total energy cost			346.6000 (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	4734.4568	0.2160	1022.6427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2587.0980	0.2160	558.8132 (264)
Space and water heating			1581.4559 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	506.7557	0.5190	263.0062 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1494.5328 (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	4734.4568	1.2200	5776.0373 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2587.0980	1.2200	3156.2596 (264)
Space and water heating			8932.2970 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	506.7557	3.0700	1555.7400 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			8418.1279 (272)
Primary energy kWh/m ² /year			57.8804 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 88

(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	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 45	-269 kg (18.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45 1.85 kg/m ²	B 89	B 90
Total Savings	£45 1.85 kg/m ²		

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 90

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£99	£107	-£8
Mains gas	£375	£321	£54
Space heating	£286	£288	-£1
Water heating	£101	£55	£46
Lighting	£86	£86	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£347	£301	£46
Total cost of uses	£346	£302	£45
Delivered energy	49 kWh/m ²	40 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	58 kWh/m ²	47 kWh/m ²	10 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3016 (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	0.3846	0.3770	0.3695	0.3318	0.3242	0.2865	0.2865	0.2790	0.3016	0.3242	0.3393	0.3544 (22b)
Effective ac	0.5739	0.5711	0.5683	0.5550	0.5526	0.5410	0.5410	0.5389	0.5455	0.5526	0.5576	0.5628 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	65.9735	65.6435	65.3200	63.8005	63.5162	62.1928	62.1928	61.9477	62.7026	63.5162	64.0913	64.6926 (38)
Heat transfer coeff	170.6289	170.2989	169.9754	168.4559	168.1716	166.8482	166.8482	166.6031	167.3580	168.1716	168.7467	169.3480 (39)
Average = Sum(39)m / 12 =												168.4545 (39)
HLP	1.1732	1.1709	1.1687	1.1583	1.1563	1.1472	1.1472	1.1455	1.1507	1.1563	1.1602	1.1644 (40)
HLP (average)												1.1582 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0316	28.0859	28.1394	28.3932	28.4412	28.6668	28.6668	28.7089	28.5795	28.4412	28.3443	28.2436
alpha	2.8688	2.8724	2.8760	2.8929	2.8961	2.9111	2.9111	2.9139	2.9053	2.8961	2.8896	2.8829
util living area	0.9683	0.9507	0.9174	0.8500	0.7400	0.5920	0.4592	0.5081	0.7133	0.8855	0.9526	0.9727 (86)
MIT	18.9199	19.1860	19.6061	20.1275	20.5625	20.8398	20.9438	20.9236	20.7103	20.1381	19.4339	18.8663 (87)
Th 2	19.9415	19.9433	19.9451	19.9535	19.9551	19.9625	19.9625	19.9638	19.9596	19.9551	19.9519	19.9486 (88)
util rest of house	0.9629	0.9425	0.9034	0.8239	0.6940	0.5190	0.3630	0.4104	0.6476	0.8597	0.9433	0.9680 (89)
MIT 2	17.1768	17.5609	18.1628	18.8986	19.4811	19.8240	19.9286	19.9144	19.6841	18.9312	17.9291	17.1036 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.1349 (91)
MIT	17.4120	17.7801	18.3575	19.0644	19.6270	19.9610	20.0656	20.0505	19.8226	19.0940	18.1321	17.3414 (92)

AES
Sustainability
Consultants

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	5463.9977	0.2160	1180.2235 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1231.1795	0.2160	265.9348 (264)
Space and water heating			1446.1583 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	506.7557	0.5190	263.0062 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total kg/year			1427.9116 (272)
CO2 emissions per m2			9.8200 (273)
EI value			89.9527
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	72.7200 (1b)	x 2.3100 (2b)	= 167.9832 (1b) - (3b)
First floor	72.7200 (1c)	x 2.4800 (2c)	= 180.3456 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	145.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 348.3288 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1148 (8)
Pressure test					Yes
Measured/design AP50					4.8000
Infiltration rate					0.3548 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3016 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3167	0.2941	0.3016	0.2865	0.2865	0.2790	0.2714	0.2639	0.2564	0.2790	0.2639	0.2790 (22b)
	0.5501	0.5432	0.5455	0.5410	0.5410	0.5389	0.5368	0.5348	0.5329	0.5389	0.5348	0.5389 (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	0.9000	1.9170		(26)
Window (Uw = 1.40)			22.2800	1.3258	29.5379		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			72.7200	0.1500	10.9080	75.0000	5454.0000 (28a)
100mm Knauf Supafil	170.0500	28.5100	141.5400	0.2500	35.3850	60.0000	8492.4000 (29a)
External Roof 1	72.7200		72.7200	0.1300	9.4536	9.0000	654.4800 (30)
Total net area of external elements Aum(A, m ²)			315.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.6371		(33)
Internal Floor 1			72.7200			18.0000	1308.9600 (32d)
Internal Floor 1			72.7200			18.0000	1308.9600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17218.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							118.3911 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0183 (36)
Total fabric heat loss						(33) + (36) =	104.6554 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.2385	62.4444	62.7026	62.1928	62.1928	61.9477	61.7092	61.4772	61.2517	61.9477	61.4772	61.9477 (38)
Heat transfer coeff	167.8939	167.0998	167.3580	166.8482	166.8482	166.6031	166.3646	166.1326	165.9071	166.6031	166.1326	166.6031 (39)
Average = Sum(39)m / 12 =												166.6995 (39)
HLP	1.1544	1.1489	1.1507	1.1472	1.1472	1.1455	1.1439	1.1423	1.1407	1.1455	1.1423	1.1455 (40)
HLP (average)												1.1462 (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												2.9268 (42)
Average daily hot water use (litres/day)												103.7116 (43)
Daily hot water use	114.0828	109.9343	105.7858	101.6374	97.4889	93.3405	93.3405	97.4889	101.6374	105.7858	109.9343	114.0828 (44)
Energy conte	169.1815	147.9672	152.6889	133.1179	127.7298	110.2211	102.1360	117.2026	118.6024	138.2196	150.8775	163.8432 (45)
Energy content (annual)										Total = Sum(45)m =		1631.7876 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3772	22.1951	22.9033	19.9677	19.1595	16.5332	15.3204	17.5804	17.7904	20.7329	22.6316	24.5765 (46)

Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7668	(55)
Total storage loss													
23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708	(56)	
If cylinder contains dedicated solar storage													
15.2812	13.8024	15.2812	14.7883	15.2812	14.7883	15.2812	15.2812	14.7883	15.2812	14.7883	15.2812	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)	
Total heat required for water heating calculated for each month													
207.7251	182.7808	189.8368	163.6646	153.4791	134.9146	127.6527	143.6498	150.4998	175.3675	188.1778	202.3868	(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 m ²												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2438	(H8)
Utilisation factor												0.5524	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												115.5000	(H13)
Daily hot water demand												103.7116	(H14)
Volume ratio Veff/V												1.1137	(H15)
Solar storage volume factor												1.0000	(H16)
Solar input												-985.9479	(H17)
Solar input	-32.1640	-45.7352	-78.6078	-106.0601	-124.5739	-133.0646	-130.2663	-116.5923	-91.2837	-63.1104	-38.0415	-26.4482 (63)	
								Solar input (sum of months) = Sum(63)m =				-985.9479 (63)	
Output from w/h													
175.5611	137.0456	111.2290	57.6045	28.9051	1.8500	0.0000	27.0575	59.2161	112.2571	150.1363	175.9387 (64)		
								Total per year (kWh/year) = Sum(64)m =				1036.8009 (64)	
Heat gains from water heating, kWh/month													
87.0877	77.0500	80.4874	68.6990	63.0696	56.4034	54.3736	60.1276	64.9532	75.6763	80.0070	85.3128 (65)		

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	28.4882	28.6236	28.5795	28.6668	28.6668	28.7089	28.7501	28.7903	28.8294	28.7089	28.7903	28.7089
alpha	2.8992	2.9082	2.9053	2.9111	2.9111	2.9139	2.9167	2.9194	2.9220	2.9139	2.9194	2.9139
util living area	0.9606	0.9445	0.9034	0.8197	0.6937	0.5113	0.3874	0.4124	0.6457	0.8498	0.9369	0.9657 (86)
MIT	19.1159	19.3221	19.7574	20.2730	20.6718	20.9037	20.9684	20.9629	20.8025	20.3188	19.6603	19.0877 (87)
Th 2	19.9567	19.9611	19.9596	19.9625	19.9625	19.9638	19.9652	19.9665	19.9677	19.9638	19.9665	19.9638 (88)
util rest of house	0.9539	0.9353	0.8871	0.7890	0.6407	0.4333	0.2915	0.3117	0.5713	0.8162	0.9244	0.9597 (89)
MIT 2	17.4693	17.7673	18.3860	19.1018	19.6236	19.8893	19.9492	19.9474	19.7942	19.1830	18.2621	17.4337 (90)
Living area fraction									fLA = Living area / (4) =			0.1349 (91)
MIT	17.6914	17.9771	18.5710	19.2598	19.7650	20.0261	20.0867	20.0844	19.9302	19.3362	18.4507	17.6568 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													-0.1500
adjusted MIT	17.5414	17.8271	18.4210	19.1098	19.6150	19.8761	19.9367	19.9344	19.7802	19.1862	18.3007		17.5068 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9315	0.9091	0.8561	0.7592	0.6210	0.4263	0.2888	0.3085	0.5562	0.7850	0.8966	0.9390	(94)
Useful gains	967.1025	1065.4674	1155.4180	1168.9260	1004.1445	719.1803	462.4065	459.6073	746.9518	909.2856	926.3811	913.1953	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2122.4149	2093.2736	1911.3918	1603.3771	1187.1265	762.3931	471.9206	470.8855	842.8471	1297.2099	1727.8964	2083.6756	(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	859.5525	690.6857	562.4446	312.8048	136.1386	0.0000	0.0000	0.0000	0.0000	288.6157	577.0910	870.8373	(98)
Space heating												4298.1702	(98)
Space heating per m2										(98) / (4) =		29.5529	(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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4765.1554 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	859.5525	690.6857	562.4446	312.8048	136.1386	0.0000	0.0000	0.0000	0.0000	288.6157	577.0910	870.8373	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	952.9406	765.7270	623.5527	346.7902	150.9297	0.0000	0.0000	0.0000	0.0000	319.9730	639.7905	965.4516	(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	175.5611	137.0456	111.2290	57.6045	28.9051	1.8500	0.0000	27.0575	59.2161	112.2571	150.1363	175.9387	(64)
Efficiency of water heater (217)m	88.1869	88.2338	88.2391	88.3507	88.1228	79.5000	79.5000	79.5000	79.5000	86.9239	87.7614	79.5000	(216)
Fuel for water heating, kWh/month	199.0784	155.3210	126.0540	65.1998	32.8010	2.3270	0.0000	34.0346	74.4856	129.1442	171.0732	88.2047	(217)
Water heating fuel used												199.4664	(219)
Annual totals kWh/year												1188.9852	(219)
Space heating fuel - main system												4765.1554	(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)												506.7557	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												5836.6588	(238)

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4765.1554	3.9200	186.7941	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1188.9852	3.9200	46.6082	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	506.7557	16.9600	85.9458	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.9600	-127.0707	(252)
Total energy cost			301.4774	(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	4765.1554	0.2160	1029.2736	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1188.9852	0.2160	256.8208	(264)
Space and water heating			1286.0944	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	506.7557	0.5190	263.0062 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1225.1213 (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	4765.1554	1.2200	5813.4896 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1188.9852	1.2200	1450.5619 (264)
Space and water heating			7264.0515 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	506.7557	3.0700	1555.7400 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			6903.3824 (272)
Primary energy kWh/m2/year			47.4655 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	118.4 (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	459.79 (P1)
Transmission heat loss coefficient	104.66 (37)
Summer heat loss coefficient	564.45 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
North East	0.000	1.000	None
South East	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	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
North East	1.000	0.90	1.000	0.900 (P8)
South East	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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.2100	87.1704	0.7100	0.7000	0.9000	112.6460
North East	0.5700	106.0502	0.7100	0.7000	0.9000	24.3348
South East	6.0000	127.3119	0.7100	0.7000	0.9000	307.5116
South West	1.1300	127.3119	0.7100	0.7000	0.9000	57.9147
West	3.2100	125.2818	0.7100	0.7000	0.9000	161.8953
North West	8.1600	106.0502	0.7100	0.7000	0.9000	348.3719
South East	4.1000	127.3119	0.7100	0.7000	0.9000	210.1329
total:						1222.8073

	Jun	Jul	Aug	
Solar gains	1318	1223	1075	(P3)
Internal gains	613	589	599	
Total summer gains	1931	1812	1674	(P5)
Summer gain/loss ratio	3.42	3.21	2.97	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 118.4)	1.17	1.17	1.17	
Threshold temperature	19.99	21.68	21.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Assessment of likelihood of high internal temperature: Slight